
**Ground Floor Offices
Paragon Mill, Manchester**

Building Services Noise Survey

Project: Paragon Mill Offices - Plant Noise Survey

Client: NQC Ltd

Project Reference: RSA314A/2020

Report Date: 13 June 2022

Document History

Version	Date	Comments	Initials
1	13 June 2022	Issue for planning	RS / MP

Authorised by	Ryan Swales, BSc, MIOA Director & Principal Consultant
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1. Introduction

- 1.1 RS Acoustic Engineering Ltd have been appointed by NQC Ltd to undertake a noise survey with regard to the new building services plant associated with the recently constructed office accommodation within the ground floor of Paragon Mill, No.4 Cotton Street, Manchester, M4.
- 1.2 The development was granted full planning permission in July 2020 subject to a number of conditions. With regard to building services plant and the associated noise, condition no.5 previously applied, however following installation constraints with regard to noise control measures, the condensing unit specification was amended prior to installation.
- 1.3 Condition no.3 of the planning permission states that the air conditioning units should not operate outside of typical office hours (Monday to Friday, 9:00 to 17.30).
- 1.4 An environmental noise survey was previously conducted in March 2020 in order to determine the lowest and typical background sound levels during the daytime period. The measured background sound levels were used to determine ideal design noise targets for the new building services plant.
- 1.5 A site visit was conducted in June 2022 in order to inspect the plant installation, conduct subjective observations at the neighbouring dwellings and conduct sample measurements with the plant items operating.
- 1.6 The survey and assessment was conducted by Mr Ryan Swales (BSc(Hons), MIOA), Principal Acoustic Consultant and Corporate Member of the Institute of Acoustics.
- 1.7 The report provides details of the previously measured background sound levels, ideal noise targets, details of the newly installed plant and the results of the plant noise survey.

2. Assessment Criteria & Guidance

Manchester City Council Planning Condition

- 2.1 The following noise related planning condition was attached to the planning permission:

5) a) *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 5 dB (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise sensitive location.*

In order to achieve this, the development hereby approved shall be carried out in accordance with the recommendations within the Noise Assessment by RS Acoustic Engineering, stamped as received on the 23rd June and the Air Conditioning Acoustic Kit Specification, stamped as received on the 17th June 2020 for Planning Purposes,

b) Upon completion of the development and before any of the external plant is first operational, a verification report will be required to validate that the work undertaken confirms to the above noise criteria. The report shall give the results of post-completion testing to confirm that the proposed noise limits are being achieved once the plant and any mitigation measures have been installed. Any instances of non-conformity with the above criteria shall be detailed along with any measures required to ensure compliance. The report and any necessary measures shall be approved in writing by the City Council as Local Planning Authority and the development shall be implemented in full in accordance with the approved details before the plant is first brought into use.

Reason - To safeguard the amenities of the occupiers of nearby residential accommodation, pursuant to policies SP1 and DM1 of the Core Strategy.

British Standard 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound

- 2.2 BS 4142 describes methods for rating and assessing sound of an industrial and/or commercial nature, such as sound from manufacturing processes and fixed mechanical plant/machinery.
- 2.3 Outdoor sound levels are used to assess the likely effect on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident. The standard is not intended to be applied to the derivation of indoor sound levels arising from sound levels outside, or the assessment of indoor sound levels.
- 2.4 The standard states that a difference of around +10 dB or more (excess of rating level above the background sound level) is likely to be an indication of a significant adverse impact, depending on the context.
- 2.5 A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context. The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact.
- 2.6 Where the rating level does not exceed the background sound level, the standard states that this is an indication of the specific sound source having a low impact, depending on the context.

3. Plant Details & Survey Results

Building services plant details

- 3.1 There are three outdoor condensing units installed at ground floor level within an enclosed private car park. The condenser units are required to serve the air-conditioning system.
- 3.2 The condenser model types are as follows:
- 2 x Samsung AM100KXMDGH units
 - 1 x Samsung AM050NXMDER unit
- 3.3 The office space is mechanically ventilated via three heat recovery units located within the internal ceiling void. The units simultaneously supply fresh air whilst extracting stale air.
- 3.4 The photographs below show the new Samsung condensing units and the air intake/exhaust louvres.
- 3.5 There are apartments within the upper floors of Paragon Mill, however the plant is visually and acoustically screened from the windows above due to a notable recess in the building between ground and first floor level. There are also apartment windows on the opposite side of the carpark with a line-of-sight to the plant installation.

Figure 3.1 - Photographs showing outdoor condensing units and air intake/extract louvres

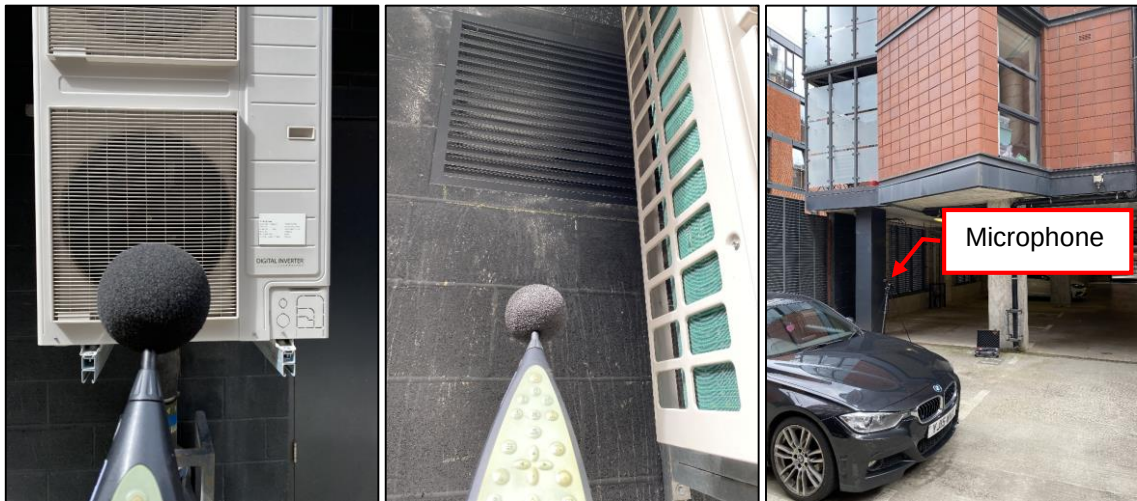


Sample sound level measurements of external plant

Survey methodology

- 3.6 A site visit was conducted on the morning of Tuesday 7th June 2022 in order to inspect the installation, conduct subjective observations at neighbouring dwellings and conduct a number of sample noise measurements with the plant operating at typical operating duty.
- 3.7 Short measurement intervals were necessary for the survey (60 second intervals), since background and ambient sound levels without the plant operating are approximately 48 to 50 dB $L_{A90,15min}$ and 58 to 63 dB $L_{Aeq,15min}$ during the morning period (generated by passing road traffic on Jersey Street).
- 3.8 The photographs overleaf show the measurement positions used during the survey.

Figure 3.2 - Photographs showing survey measurement positions



3.9 The survey was performed using the following Class-1 specification equipment:

- Brüel & Kjaer 2260-Light data logging sound level meter, microphone type 4189 and pre-amplifier type ZC0032.
- CEL-120/1 Acoustic calibrator.

3.10 Calibration of the sound level meter and microphone used for the measurements are traceable to UKAS accredited laboratories. Calibration certificates are provided within Appendix A.

3.11 The calibration of both sound level meter and microphone was checked using a 1 kHz tone at 94 dB prior to and following the survey. The drift in calibration was less than 0.1 dB.

Results summary

3.12 Table 3.1 presents a summary of the measured sound pressure levels. Measured values have been rounded to the nearest whole number.

Table 3.1 - Summary of measured plant sound pressure levels

Start Time	Plant Item	$L_{Aeq,60sec}$ dB	Comments
10:41	Air extract	50	0.5 m from extract louvre
10:42	Air intake	49	0.5 m from intake louvre
10:44	Air intake and extract	39	Below adjacent apartment
10:50	Samsung AM100	57	1 m from unit
10:57	Condensers & intake/extract	43	Below adjacent apartment
11:05	Condensers & intake/extract	43	Below adjacent apartment

3.13 The results of the sample measurements indicate that the cumulative sound pressure level for the condensing units and air intake/extract is 43 dB $L_{Aeq,60sec}$.

3.14 The measured specific sound pressure level is considered to be equal to the sound rating level in this instance, since the plant does not generate significant tonal or attention catching characteristics.

3.15 It is not possible to measure the sound pressure levels from the plant items over a 15-minute or 60-minute interval, since the local ambient and background sound levels are moderately high when the plant is not operating (i.e. it is difficult to measure the plant operating alone without the influence of noise from external sources such as road traffic and pedestrians).

- 3.16 However, sample measurements over 60-second intervals are considered appropriate since the plant will generally operate in a steady-state manner.
- 3.17 The survey results from March 2020 indicate that the typical (modal) background sound level during the daytime operating hours was 48 dB $L_{A90,15min}$ and the lowest background sound level was 47 dB $L_{A90,15min}$.
- 3.18 The cumulative sound pressure levels for the condensing units and air intake/extract is therefore approximately 5 dB below the typical background sound level and 4 dB below the lowest background sound level.
- 3.19 Manchester City Council state that the sound rating level from all new building services plant should ideally be at least 5 dB below the typical background sound level.
- 3.20 It should also be noted that BS 4142 states '*Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context*'.
- 3.21 The sound rating level of the newly installed plant therefore achieves the design target based on the previously measured typical background sound level.

4. Conclusion

- 4.1 The air conditioning plant will not operate outside of typical office hours (09:00 to 17.30).
- 4.2 It was considered impractical to install an acoustic enclosure/screen around the originally proposed condensing units, due to being restricted by the close proximity of the adjacent car parking space (i.e. the screen would project into the adjacent space) and therefore alternative units were selected.
- 4.3 The cumulative sound pressure level for the condensing units and air intake/extract is approximately 5 dB below the typical background sound level and 4 dB below the lowest background sound level.
- 4.4 The sound rating level of the newly installed plant achieves the design target based on the previously measured typical background sound level.
- 4.5 Subjectively, the noise generated by the condensing units and air intake/extract is considered to be acceptable and is unlikely to cause disturbance within neighbouring habitable rooms.

Appendix A

Equipment calibration certificates

Certificate of Calibration

Issued by University of Salford (Acoustics Calibration Laboratory)
UKAS ACCREDITED CALIBRATION LABORATORY NO. 0801

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APPROVED SIGNATORIES

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University of
Salford
MANCHESTER

Certificate Number: 05397/2

Date of Issue: 22 July 2021

VERIFICATION OF A TYPE 1 SOUND LEVEL METER to BS7580 Part 1

FOR:	RS Acoustic Engineering Ltd 76 Marple Road Stockport Cheshire SK02 5QH
FOR THE ATTENTION OF:	Ryan Swales
DATE RECEIVED:	16 July 2021
CALIBRATION DATE:	22 July 2021
LOCATION OF CALIBRATION:	Acoustic Calibration Laboratory, Newton G31, University of Salford
TEST PROCEDURE:	CTP08 (Laboratory Manual)

Calibration item details:-

Type	Manufacturer	Model	Serial Number
Sound Level Meter	B&K	2260	2114970
Microphone	B&K	4189	2643196
Preamplifier	B&K	ZC 0026	-
Calibrator	CEL	120/1	33211859

Test Engineer (initial):	GP	Name:	Gary Phillips
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Results in this certificate relate only to instruments tested.

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to the units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full except with the prior written approval of the issuing laboratory.

Certificate of Calibration

Issued by University of Salford (Acoustics Calibration Laboratory)
UKAS ACCREDITED CALIBRATION LABORATORY NO. 0801

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Certificate Number: 05397/2

Date of Issue: 22 July 2021

SET-UP INFORMATION

The instrument was running software module BZ7202 Version 1.1. The reference range, reference SPL, primary indicator range, pulse range and linearity range as specified by the manufacturer have been used. The instrument was adjusted to read 94.2 dB (A) in response to the associated calibrator. This reading was obtained from the calibration certificate of the calibrator, 05397/1 and information in the manufacturer's instruction manual, with the instrument S.I.Corr set to Frontal, when the instrument is fitted with the supplied UA0237 windscreen.

MEASUREMENTS

The levels of self-generated noise were:

A:	13.2	dB
C:	15.0	dB
Lin:	21.7	dB

At the end of the tests the indication of the sound level meter in response to the associated sound calibrator was 94.2 dB (A) which corresponds to the following level at 101.325 kPa:

Sound Pressure Level 94.2 dB (A)

This reading should be used henceforth to set up the sound level meter for field use.

THE SOUND LEVEL METER WAS VERIFIED ACCORDING TO THE PROCEDURE GIVEN IN BS7580: Part 1 1997 WITH THE FOLLOWING EXCEPTIONS:

- The microphone corrections applied as specified in BS 7580: Part 1: 1997 were obtained from a frequency response measurement by this Laboratory using the electrostatic actuator method. The response in isolation is not covered by our UKAS accreditation.
- A stricter test than that specified in 5.5.10 and 5.5.11 of BS 7580 has been used by not applying the low level signal.

STATEMENT OF RESULT:

THE SOUND LEVEL METER CONFORMS* TO THE TYPE 1 REQUIREMENTS OF BS7580: PART1 1997.

*Specification: Calibration and tolerances as defined by the requirements defined in BS 7580 Part 1: 1997.

*Decision Rule: Conformance is demonstrated when the instrument conforms with the accuracy requirements defined in BS 7580 Part 1: 1997 AND the expanded measurement uncertainty ($k = 2$ for approximately 95 % coverage probability) is no greater in magnitude than the accuracy requirements in defined in BS 7580 Part 1: 1997.

Instruments used in the verification procedure were traceable to National Standards. The method of acoustic calibration employed a standard sound pressure calibrator for the 1 kHz test whilst the tests at 125 Hz and 8 kHz were performed by the electrostatic actuator method. The uncertainty of the Laboratory's 1 kHz calibrator was ± 0.06 dB. The uncertainty of the standard calibrator is not included in the applied tolerances. It is assumed that the sound level meter was manufactured in accordance with BSEN60651: 1994 Type 1, and BSEN60804: 1994 Type 1.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements. All measurement results are retained at the acoustic calibration laboratory for at least four years.

-----END OF CERTIFICATE-----

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to the units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full except with the prior written approval of the issuing laboratory.

Appendix B

Assessment terminology

Assessment terminology

Term	Description
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure ($2 \times 10^{-5} \text{Pa}$).
dB(A)	The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq} , L_{A90} etc, according to the parameter being measured.
Acoustic environment	Sound from all sources as modified by the environment.
Ambient sound level	The totally encompassing sound in a given situation at a given time; it is usually composed of sound from many sources, near and far.
Background sound level	The sound level in the absence of a specific noise source under consideration (e.g. plant/machinery), measured as $L_{A90,T}$.
Residual sound	Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.
Specific sound source	Sound source being assessed.
Specific sound level	Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T.
Rating level $L_{Ar,T}$	Specific sound level plus any adjustment for the characteristic features of the sound.