



Environmental Equipment Corporation Ltd
Richmond House, Churchfield Road
Walton on Thames
Surrey. KT12 2TP
t: 01932 230940
f: 01932 230941
e: info@eec.co.uk

Project:

**UCL LMS Small Works - SW18
Anatomy Building**

Title:

Plant Noise Impact Assessment



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Author	Adeola Badejo Acoustic Engineer 		
Checked	Jon Mudd BEng(Hons) MIOA Director 		
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CONTENTS:

1	INTRODUCTION	1
2	SITE	1
3	GUIDANCE	2
4	MEASUREMENTS	3
5	EQUIPMENT	3
6	RESULTS	4
7	PLANT ASSESSMENT	4
8	CONCLUSIONS	6

APPENDIX A:
APPENDIX B:
APPENDIX C:
APPENDIX D:
APPENDIX E:
APPENDIX F:

Glossary of Technical Terms
Site Plan & Measurement Location
Planning Policy & Guidance
Survey Results (Tabular)
Survey Results (Graphical)
Published Plant Noise Data



1 INTRODUCTION

- 1.01 Environmental Equipment Corporation Limited has been commissioned by Fusion Project Management Ltd to undertake a noise assessment of five new condenser units to serve the existing office spaces of the UCL Anatomy Building.
- 1.02 This noise assessment has been conducted in accordance with the policies and requirements of London Borough of Camden Council (LBCC) and is based on a noise survey carried out at the site over an extended period.
- 1.03 This assessment includes:
- the setting of plant noise limits in accordance with the requirements of LBCC and national planning policy, standards and guidance; and
 - the prediction of noise impacts at the worst affected noise sensitive receptors based on the proposed items of plant and their location.
- 1.04 This report is prepared solely for Fusion Project Management Ltd. Environmental Equipment Corporation Limited accepts no responsibility for its use by any third party. Note that the contents contained herein are produced for the purposes of review by relevant Planning Authority departments and do not constitute a detailed design or specification document to be used for the purposes of construction. Subsequent development of noise mitigation schemes shall engage EEC Ltd and Fusion Project Management Ltd so as to support the conclusions of this report.
- 1.05 Whilst every effort has been made to ensure that this report is easy to understand, it is necessarily technical in nature. To assist the reader, an explanation of the terminology used in this report is contained in Appendix A.

2 SITE

- 2.01 The Anatomy Building is a large multi-storey and multi-block medical education facility located on the UCL Bloomsbury Campus in a mixed commercial and residential area of Bloomsbury.
- 2.02 The property is bound by the following:
- North – UCL Chadwick building, educational faculty;
 - East – Rear facades of the Medical Sciences building;
 - South – UCL Darwin building, educational faculty; and
 - West – Arthur Tattersall House & Janet Poole House student accommodation.
- 2.03 This application is for five new Daikin condensing units, two model RXM20R9, two model RXM50R9 and a single model RXM35R9, which will replace the existing condensing units in the rooftop plant area, as presented in Appendix B.
- 2.04 The proposed units will only operate between the hours of 0700 – 1800 daily.
- 2.05 The closest noise sensitive receptors to the proposed plant items are the following:
- Arthur Tattersall House student accommodation.
- 2.06 All other noise sensitive receptors are at a greater distance from the proposed location of the units, or are protected by more screening by the intervening structures, and as such will be subject to lower levels of noise.

3 GUIDANCE

3.01 Local and National Planning Policy for the London Borough of Camden Council (CLBC) is presented in Appendix C of this document.

3.02 The below extract is taken from CLBC supplementary planning guidance for protection of Amenity dated January 2021 and provides guidance on how the Local Authority will assess acoustic reports:

“When assessing acoustic reports, the council will consider the reported measurements against the noise thresholds set out in Appendix 3 of the Local Plan. The thresholds are expressed as ‘effect levels’, which sets out a hierarchy of expected changes in behaviour and impact on health and wellbeing in response to increasing noise levels (measured in decibels – dB) The ‘effect levels’ are summarised below and explained in detail in National Planning Practice Guidance (NPPG).

- No observed effect level (NOEL) – the level below which no effect can be detected on health and quality of life.
- Lowest observable adverse effect level (LOAEL) – the level above which changes in behaviour (e.g. closing windows for periods of the day) and adverse effects on health (e.g. sleep disturbance) and quality of life can be detected.
- Significant observed adverse effect level (SOAEL) – the level above which adverse effects on health and quality of life occur. This could include psychological stress, regular sleep deprivation and loss of appetite.”

3.03 NPPG does not define any of the above effect levels numerically.

3.04 In accordance with the current National Planning Policy the noise impact from new plant should be assessed in line with the requirements of ‘BS4142:2014: Methods for rating and assessing industrial and commercial sound’. The methodology provided can be used to assess the likelihood of any adverse impacts numerically based on the noise emitted as it affects noise sensitive receivers, including any corrections for the character of the noise against existing background noise levels.

3.05 Appendix 3 of the Local Plan includes noise threshold values adopted in the Borough when assessing the day-to-day operation of plant as it affects existing residential amenity, a copy of which is included in Appendix C of this report and summarised below.

3.06 Proposals are categorised using a traffic light system as follows:

- **Green** Where noise is considered to be at an acceptable level
(plant noise is -10dB with respect to the background noise level)
LOAEL
- **Amber** A range over which the impact of the noise could be considered adverse to varying degrees though maybe acceptable when considered in context
(plant noise ranges between -5dB to +5dB with respect to the background noise level)
LOAEL - SOAEL
- **Red** Where noise is observed to have a significant adverse effect
(plant noise is greater than 5dB above the background noise level)
SOAEL

4 MEASUREMENTS

- 4.01 Environmental noise measurements were carried out over an extended period, between 1230 hours on Monday 9th January 2022 and concluded 1030 hours Thursday 12th January, 2022, to establish the existing noise levels at the site. The survey methodology and results are set out below.
- 4.02 Noise measurements have been carried out at the following position, as shown in Appendix B and described as:
- Position 1: Located at the roof edge of the Anatomy Building, with the microphone suspended 1m away from the building façade. The measurement was not located within 3.5 metres of any reflecting surfaces, other than the mounting surface.
- 4.03 This position is considered to be representative of the nearest windows to the proposed AC unit location.

5 EQUIPMENT

- 5.01 The equipment used for the survey was as follows:-

- 01dB Fusion Integrating Sound Level Meter conforming to Class 1 BS EN 61672, Type 1 BS EN 60804 & BS EN 60651: 1994;
- GRAS 40CD Condenser Microphone, PRE22 S Pre-amp and Connecting Leads;
- Tripod.

- 5.02 The equipment holds current accreditation and serial numbers as follows:

Sound Level Meter 01dB Fusion	Serial No.	14014
	Calibration Date	22 nd April 2021
	Cal Certificate No.	NOT1536
½" Condenser Mic. GRAS 40CD	Serial No.	383172
	Calibration Date	22 nd April 2021
	Cal Certificate No.	48982
Calibrator CAL 31	Serial No.	94723
	Calibration Date	21 st April 2022
	Cal. Certificate No.	154501

N.B. Copies of calibration certificates are available upon request.

- 5.03 The equipment was calibrated both before and after the survey with no difference noted in the levels.

6 RESULTS

- 6.01 The weather during the survey was suitable for noise measurement, it being mostly dry with little wind for the duration of the survey.
- 6.02 Noise sources at the site include local and distant road traffic, there were no other significant sources of noise on site. The existing plant in close proximity to the measurement position was not in operation throughout the entire measurement duration.
- 6.03 A list of the levels measured is included in Appendix D and represented graphically in Appendix E.
- 6.04 A summary of the time averaged ambient levels and lowest measured background levels over the measurement periods are shown in Table 6.1. The minimum L_{A90} is the lowest fifteen-minute measurement in the specified period.

Position	Period	Average $L_{Aeq,T}$ – dB	Minimum L_{A90} – dB
1	Proposed Operation (0700-1800 hrs)	66	55

Table 6.1: Free-Field Measured Ambient and Lowest Background Noise Levels

7 PLANT ASSESSMENT

- 7.01 This application is for the installation of five new plant items to replace existing condensing units in a rooftop plant area, to the north of the site.
- 7.02 The proposed new plant items will only operate through the hours of 0700 – 1800 daily.
- 7.03 Based on the standard requirements of Camden London Borough Council and as described in sections 3.01 – 3.03, the NOEL is achieved when plant noise is at least 10 dB below the lowest measured background noise level in each time period.
- 7.04 In accordance with the requirements of LBCC to achieve a ‘green’ rating the proposed noise limits are based on being 10 dB below the measured background noise level.

Location	Period	Measured Existing $L_{A90,T}$	Proposed Noise Limit L_{Ar}
Arthur Tattersall House	Proposed Operation (0700-1800)	55 dB	45 dB

Table 7.1: Suggested Plant Noise Emission Limits Based on Lowest Measured L_{A90} , Free-field dB

- 7.05 Note that the limits suggested above are rating levels and as such any design should take into account the acoustic characteristics of the plant. In this instance the proposed units display none of the characteristics whereby the acoustic correction should be applied.
- 7.06 Assuming the proposed items meet the noise limits set out in Table 7.1 noise will be below the NOEL with respect to the NPPF.
- 7.07 The below table presents the manufacturer stated Sound Pressure Levels for the proposed plant items. Copies of the manufacturer’s plant data sheets are included in Appendix F.

Plant Item	Quantity	Sound Pressure Level at 1m	
Daikin RXM20R9	2	50 dB(A)	
Daikin RXM35R9	1	49 dB(A)	
Daikin RXM50R9	2	52 dB(A)	
		Cumulative SPL	56 dB(A)

Table 7.2: Manufacturer stated Sound Pressure Levels for the proposed condensing units

- 7.08 Predicted noise levels have been calculated at the closest noise sensitive windows, east facing front windows of Arthur Tattersall House student accommodation.
- 7.09 Other residential receptors located further from the site will be subject to lower noise levels than those predicted at the above locations.
- 7.10 Tables 7.3 & 7.4 present the results of worst-case plant noise predictions at the worst-case locations.

Item	Noise Level	Notes
Daikin Condenser Units	56 dB(A)	Cumulative sound pressure level at 1m
Barrier Effect	- 9 dB	No line of sight to proposed plant location
Spherical area Losses over 20 metres	- 26 dB	Distance to closest window
Reflections	0 dB	No additional reflections
Resultant Noise Level	21 dB(A)	Arthur Tattersall House

Table 7.3: Arthur Tattersall House Plant Noise Calculation

Property	Period	Proposed Noise Limit L_{Ar}	Predicted $L_{Aeq,T}$	Exceedance of noise limit
Arthur Tattersall House	Proposed Operation (0700 – 1800)	45 dB	21 dB	- 24 dB

Table 7.4: Assessment of Predicted Noise Levels Based on Proposed Noise Limit, Free-field dB(A)

- 7.11 It can be seen from the above tables that the noise limit is met during the period of the proposed condensing units operation.
- 7.12 Assuming that the proposed plant is included in the installation, predicted noise levels will meet the requirements of the Local Authority to achieve a 'green' rating during all periods of operation and at the closest noise sensitive receptors.
- 7.13 With respect to the NPPF, achieving the noise limits would be classified as being below the NOEL.

8 CONCLUSIONS

- 8.01 Fusion Project Management Ltd has appointed Environmental Equipment Corporation Limited to undertake a noise assessment of five new condensing units to serve the existing educational faculty of the UCL Anatomy Building.
- 8.02 The assessment has been carried out in accordance with national planning guidance and the requirements of the London Borough of Camden Council (LBCC), and is based on an environmental noise survey conducted at the site over a mid-week period.
- 8.03 A noise assessment has been undertaken to evaluate the potential noise impact of the proposed condensers at the closest existing residential receptors of Arthur Tattersall House student accommodation.
- 8.04 Plant noise limits have been set based on the methodology contained in BS4142, the results of a background noise survey and the requirements of LBCC, to control the noise from the proposed condenser units. In accordance with the LBCC to achieve a 'green' rating with regards to noise impact, the noise limit has been set 10 dB below the lowest measured background noise level.
- 8.05 Predictions have shown that the noise criterion is met at all assessment locations during all periods of the condenser's proposed operation assuming, the proposed plant is included in the installation.
- 8.06 Assessing the site in accordance with the principles of the National Planning Policy Framework has shown that predicted noise levels would be below the level at which no effects are observed to occur, the NOEL.
- 8.07 On the basis of this assessment it is considered that noise does not pose a material constraint to the operation of the condenser units.

APPENDIX A

GLOSSARY OF TECHNICAL TERMS

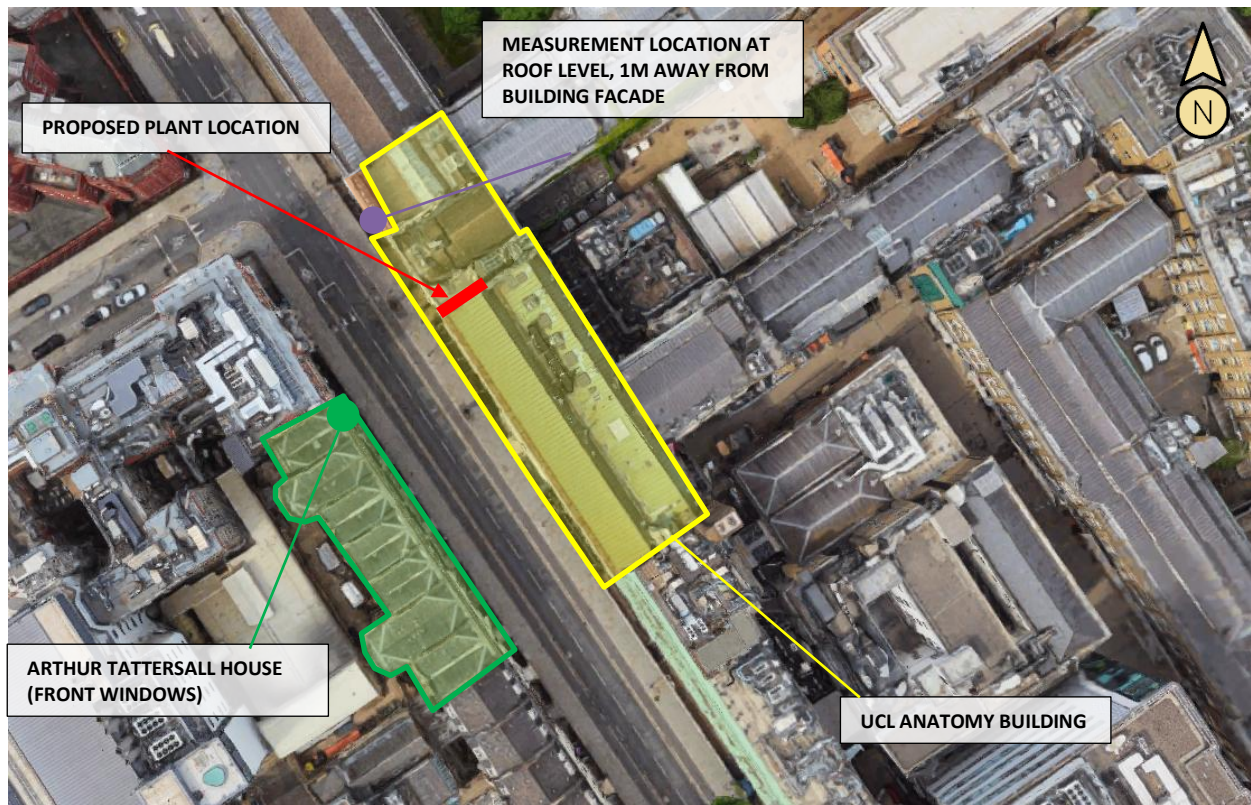
quietly moving forward

ACOUSTIC TERMINOLOGY

Absorption Classes	The sound absorption of a material is rated from Class A to Class E, where Class A materials provide the highest level of sound absorption.
Ambient Noise Levels	Noise levels measured in the absence of noise requiring control, frequently measured to determine the situation prior to the additional of a new noise source.
dB	Decibel. The logarithmic unit of sound level.
dBA	A-weighted decibel. The A-weighting approximates the response of the human ear.
$D_{nT,w}$	Weighted standardized level difference. A single number quantity of the sound level difference between two rooms. $D_{nT,w}$ is typically used to measure the on-site sound insulation performance of a building element such as a wall, floor or ceiling. Measured in accordance with BS EN ISO 16283-1 and weighted in accordance with BS EN ISO 717-1.
$D_{n,e,w}$	The weighted element-normalized level difference. A single number rating of the sound reduction provided by a sound passing through an individual element. $D_{n,e,w}$ is typically used to define the sound insulation provided by ventilators. Measured in accordance with BS EN ISO 10140-2:2010 and rated in accordance with BS EN ISO 717-1.
Flanking	Transmission of sound energy through paths adjacent to the building element being considered. For example, sound may be transmitted around a wall by travelling up into the ceiling space and then down into the adjacent room.
Frequency	Sound can occur over a range of frequencies extending from the very low, such as the rumble of thunder, up to the very high such as the crash of cymbals. Sound is generally described over the frequency range from 63Hz to 4kHz, roughly equal to the range of frequencies on a piano.
Impact Sound	Sound produced by an object impacting directly on a building structure, such as footfall noise or chairs scrapping on a floor.
$L_{Aeq,t}$	The equivalent continuous sound level measured in dBA. This is commonly referred to as the average noise level. 't' is the interval time for the measurement. Typically 't' of 16hrs and 8hrs is used for day and night time ambient noise respectively or 't' is defined by the period of interest in BS4142 assessments.
$L_{A90,t}$	The noise level exceeded for 90% of the measurement period, measured in dBA. This is commonly referred to as the background noise level.
$L'_{nT,w}$	Weighted, standardized impact sound pressure level. A single number rating of the impact sound insulation of a floor/ceiling when impacted on by a standard "tapper" machine. The lower the $L'_{nT,w}$, the better the acoustic performance. Measured in accordance with BBS EN ISO 140-7 and rated in accordance with BS EN ISO 717-2.
NR	Noise Rating. A single number rating which is based on the sound level in the octave bands 31.5Hz – 8kHz inclusive, generally used to assess noise from mechanical services in buildings.
Octave Band	Frequencies are often grouped together into octaves for analysis. Octave bands are labelled by their centre frequency which are: 63Hz, 125Hz, 250Hz, 500Hz, 1kHz, 2kHz and 4kHz.
Reverberation Time (T_{mf})	Reverberation time is used for assessing the acoustic qualities of a space. It is defined as the time it takes for an impulse to decay by 60dB. T_{mf} is the arithmetic average of the reverberation time in the mid frequency bands (500Hz, 1kHz and 2kHz).
R_w	Weighted sound reduction index. A single number rating of the sound insulation performance of a specific building element. R_w is measured in a laboratory. R_w is commonly used by manufacturers to describe the sound insulation performance of building elements such as plasterboard and concrete. Measured in accordance with BS EN ISO 10140-2:2010 and rated in accordance with BS EN ISO 717-1.
Sound Absorption	When sound hits a surface, some of the sound energy is absorbed by the surface material. Sound absorption refers to the ability of a material to absorb sound, rated from 0, complete reflection, to 1, complete absorption.
Sound Insulation	When sound hits a surface, some of the sound energy travels through the material. 'Sound insulation' refers to the ability of a material to prevent the travel of sound.
Structure-borne transmission	Transmission of sound energy as vibrations via the structure of a building.

APPENDIX B

SITE PLAN & MEASUREMENT LOCATION



APPENDIX C

PLANNING POLICY AND GUIDANCE

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Camden Local Plan Appendix 3 – Noise Thresholds

Table C: Noise levels applicable to proposed industrial and commercial developments (including plant and machinery)

Existing Noise sensitive receptor	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAL (Red)
Dwellings**	Garden used for main amenity (free field) and Outside living or dining or bedroom window (façade)	Day	'Rating level' 10dB* below background	'Rating level' between 9dB below and 5dB above background	'Rating level' greater than 5dB above background
Dwellings**	Outside bedroom window (façade)	Night	'Rating level' 10dB* below background and no events exceeding 57dBL _{Amax}	'Rating level' between 9dB below and 5dB above background or noise events between 57dB and 88dB L _{Amax}	'Rating level' greater than 5dB above background and/or events exceeding 88dBL _{Amax}

*10dB should be increased to 15dB if the noise contains audible tonal elements. (day and night). However, if it can be demonstrated that there is no significant difference in the character of the residual background noise and the specific noise from the proposed development then this reduction may not be required. In addition, a frequency analysis (to include, the use of Noise Rating (NR) curves or other criteria curves) for the assessment of tonal or low frequency noise may be required.

**levels given are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises.

The periods in Table C correspond to 0700 hours to 2300 hours for the day and 2300 hours to 0700 hours for the night. The Council will take into account the likely times of occupation for types of development and will be amended according to the times of operation of the establishment under consideration.

There are certain smaller pieces of equipment on commercial premises, such as extract ventilation, air conditioning units and condensers, where achievement of the rating levels (ordinarily determined by a BS:4142 assessment) may not afford the necessary protection. In these cases, the Council will generally also require a NR curve specification of NR35 or below, dependant on the room (based upon measured or predicted Leq,5mins noise levels in octave bands) 1 metre from the façade of affected premises, where the noise sensitive premise is located in a quiet background area.

National Planning Policy Framework and the Noise Policy Statement for England

The Department for Communities and Local Government published the National Planning Policy Framework (NPPF) on 27th March 2012 (as amended on 20th July 2021) and upon its publication, the majority of planning policy statements and guidance notes were withdrawn, including Planning Policy Guidance 24 Planning and Noise, which previously presented the government's overarching planning policy on noise.

Paragraph 174 in Section 15 of the NPPF (2021), entitled Conserving and enhancing the natural environment, states that:

"Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability..."

Paragraph 185 in Section 15 also states that:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason..."

The Department for Environment Food and Rural Affairs published the Noise Policy Statement for England (NPSE) in March 2010. The explanatory note of NPSE defines the following terms used in the NPPF:

"NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

2.21 Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur."

The NPSE does not define any of the above effect levels numerically.

The NPSE presents the Noise Policy Aims as:

“Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy and sustainable development:

avoid significant adverse impacts on health and quality of life;

mitigate and minimise adverse impacts on health and quality of life; and

where possible, contribute to the improvement of health and quality of life.”

It can be seen that the first two bullet points are similar to Section 11 of the NPPF, with a third aim that seeks to improve health and quality of life. The NPSE later expands on the Noise Policy Aims, stating:

2.23 *The first aim of the NPSE states that significant adverse effects on health and quality of life should be avoided while also taking into account the guiding principles of sustainable development (paragraph 1.8).*

2.24 *The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur.*

2.25 *This aim (the third aim), seeks where possible, positively to improve health and quality of life through the pro-active management of noise while also taking into account the guiding principles of sustainable development (paragraph 1.8), recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim.”*

It is clear that noise described in the NPSE as SOAEL that would lead to significant adverse effects should be avoided, although there is no definition as to what constitutes a significant adverse effect. Similarly, noise should be mitigated where it is high enough to lead to adverse effects, termed the LOAEL, but not so high that it leads to significant adverse effects.

British Standard 4142

To assess the acceptability of the resultant noise levels we have consulted the relevant standards. BS 4142:2014 ‘Methods for rating and assessing industrial and commercial sound’ has been used to assess the likelihood any adverse impacts based on the resultant noise level from the new plant item, including any corrections for the character of the noise against the existing background noise level.

BS4142 gives guidance on assessing the likelihood of adverse impacts by calculating a ‘rating level’ of the new noise source and comparing its magnitude at noise sensitive locations to the existing or underlying background noise level. The background noise level is subtracted from the ‘rating level’ to assess the likelihood of complaints:

- The greater the difference the greater the likelihood of complaints.
- A difference of around +10dB or more is an indication of a significant adverse impact, depending on the context.
- A difference of +5dB 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 noise level, the less likely it is that the specific sound source will have an adverse impact or significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low sound impact, depending on the context.

This assessment is carried out over a one hour period for the daytime and a fifteen minute period for the night-time. For the purposes of the standard it states that daytime and night-time are typically 07:00 to 23:00 hours and 23:00 to 07:00 hours respectively.

The 'rating level' of the noise source is obtained taking the following factors into consideration:

- The new plant noise (the specific noise) is measured or predicted in terms of L_{Aeq} .
- An additional correction shall be included if the noise contains a distinguishable, discrete continuous note, if the noise contains distinct impulses or if the noise is irregular enough to attract attention. The value for any tonal noise can be an addition of up to 6dB and for impulsive noise of up to 9dB.

BS 4142 goes onto state that:

'The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context.'

BS4142 has been referenced in setting noise limits for any fixed plant proposed as part of the proposed development.

APPENDIX D

SURVEY RESULTS (TABULAR)

EC 19788 - UCI LMS Small Works - Anatomy Building

Fusion Project Management Ltd

Tabulated Noise data

Sheet 1 of 3

Time	L _{Aeq}	L _{AMax}	L _{A90}
12:30	62	75	56
12:45	63	75	58
13:00	63	73	58
13:15	63	76	57
13:30	70	98	58
13:45	64	79	58
14:00	65	87	58
14:15	74	97	57
14:30	63	77	57
14:45	64	76	58
15:00	68	95	58
15:15	65	91	57
15:30	62	73	57
15:45	64	77	59
16:00	64	84	58
16:15	63	75	57
16:30	64	85	57
16:45	65	85	57
17:00	63	78	57
17:15	63	83	56
17:30	62	73	58
17:45	64	82	57
18:00	63	82	56
18:15	63	78	57
18:30	67	92	57
18:45	64	90	57
19:00	62	78	56
19:15	62	77	56
19:30	61	74	55
19:45	62	77	56
20:00	60	71	55
20:15	60	73	54
20:30	61	73	55
20:45	61	80	55
21:00	60	73	54
21:15	61	77	55
21:30	61	71	54
21:45	61	80	54
22:00	60	74	54
22:15	61	74	54
22:30	70	94	54
22:45	60	71	54
23:00	60	75	53
23:15	60	78	53
23:30	61	76	53
23:45	59	75	53
00:00	57	73	53
00:15	59	73	53

Time	L _{Aeq}	L _{AMax}	L _{A90}
00:30	59	73	53
00:45	59	74	53
01:00	57	71	53
01:15	58	75	53
01:30	57	70	52
01:45	56	69	52
02:00	58	72	52
02:15	56	67	52
02:30	56	69	52
02:45	56	72	52
03:00	58	72	53
03:15	64	92	52
03:30	64	92	52
03:45	57	72	52
04:00	57	71	52
04:15	60	76	52
04:30	57	70	53
04:45	58	75	52
05:00	60	79	53
05:15	59	71	53
05:30	67	78	54
05:45	62	74	54
06:00	63	87	53
06:15	61	72	54
06:30	62	86	55
06:45	63	82	54
07:00	64	81	55
07:15	70	95	55
07:30	69	93	56
07:45	67	77	57
08:00	67	75	58
08:15	67	76	59
08:30	67	77	59
08:45	67	76	58
09:00	68	89	59
09:15	68	86	61
09:30	67	75	59
09:45	68	78	60
10:00	67	77	59
10:15	67	82	61
10:30	66	74	59
10:45	67	86	61
11:00	68	78	60
11:15	67	78	60
11:30	66	84	60
11:45	66	78	59
12:00	66	74	59
12:15	66	84	59

EC 19788 - UCI LMS Small Works - Anatomy Building

Fusion Project Management Ltd

Tabulated Noise data

Sheet 2 of 3

Time	L _{Aeq}	L _{AMax}	L _{A90}
12:30	67	86	60
12:45	73	95	59
13:00	65	76	59
13:15	66	87	60
13:30	65	76	59
13:45	65	76	59
14:00	74	99	60
14:15	65	80	58
14:30	65	75	59
14:45	65	77	59
15:00	63	72	58
15:15	64	79	58
15:30	65	81	59
15:45	64	81	58
16:00	65	82	59
16:15	64	78	58
16:30	67	90	59
16:45	64	76	58
17:00	64	76	59
17:15	65	89	57
17:30	64	77	57
17:45	64	75	58
18:00	64	78	59
18:15	64	75	57
18:30	64	80	57
18:45	64	86	58
19:00	63	74	57
19:15	64	88	56
19:30	64	76	56
19:45	63	78	56
20:00	63	77	56
20:15	63	79	56
20:30	64	81	57
20:45	64	74	56
21:00	64	79	56
21:15	63	72	56
21:30	64	78	55
21:45	63	75	55
22:00	63	73	55
22:15	63	76	55
22:30	64	74	56
22:45	64	78	56
23:00	62	72	54
23:15	62	75	54
23:30	63	76	55
23:45	64	82	54
00:00	61	71	54
00:15	61	74	54

Time	L _{Aeq}	L _{AMax}	L _{A90}
00:30	61	75	54
00:45	60	78	53
01:00	60	77	53
01:15	59	73	53
01:30	60	70	53
01:45	61	77	53
02:00	59	70	53
02:15	58	71	53
02:30	58	73	53
02:45	59	72	53
03:00	68	92	53
03:15	58	71	53
03:30	57	71	53
03:45	59	70	53
04:00	58	76	53
04:15	58	69	53
04:30	58	71	53
04:45	59	73	53
05:00	62	87	54
05:15	60	74	53
05:30	65	78	54
05:45	61	74	54
06:00	60	73	54
06:15	61	79	54
06:30	60	70	54
06:45	68	95	55
07:00	65	86	55
07:15	64	83	56
07:30	63	76	56
07:45	63	75	56
08:00	64	79	57
08:15	63	78	56
08:30	65	84	57
08:45	64	81	57
09:00	64	77	58
09:15	63	74	58
09:30	65	78	58
09:45	65	86	59
10:00	63	74	58
10:15	63	77	58
10:30	70	94	58
10:45	64	80	58
11:00	64	85	59
11:15	64	83	57
11:30	65	81	60
11:45	65	81	59
12:00	70	93	58
12:15	69	93	58

EC 19788 - UCI LMS Small Works - Anatomy Building

Fusion Project Management Ltd

Tabulated Noise data

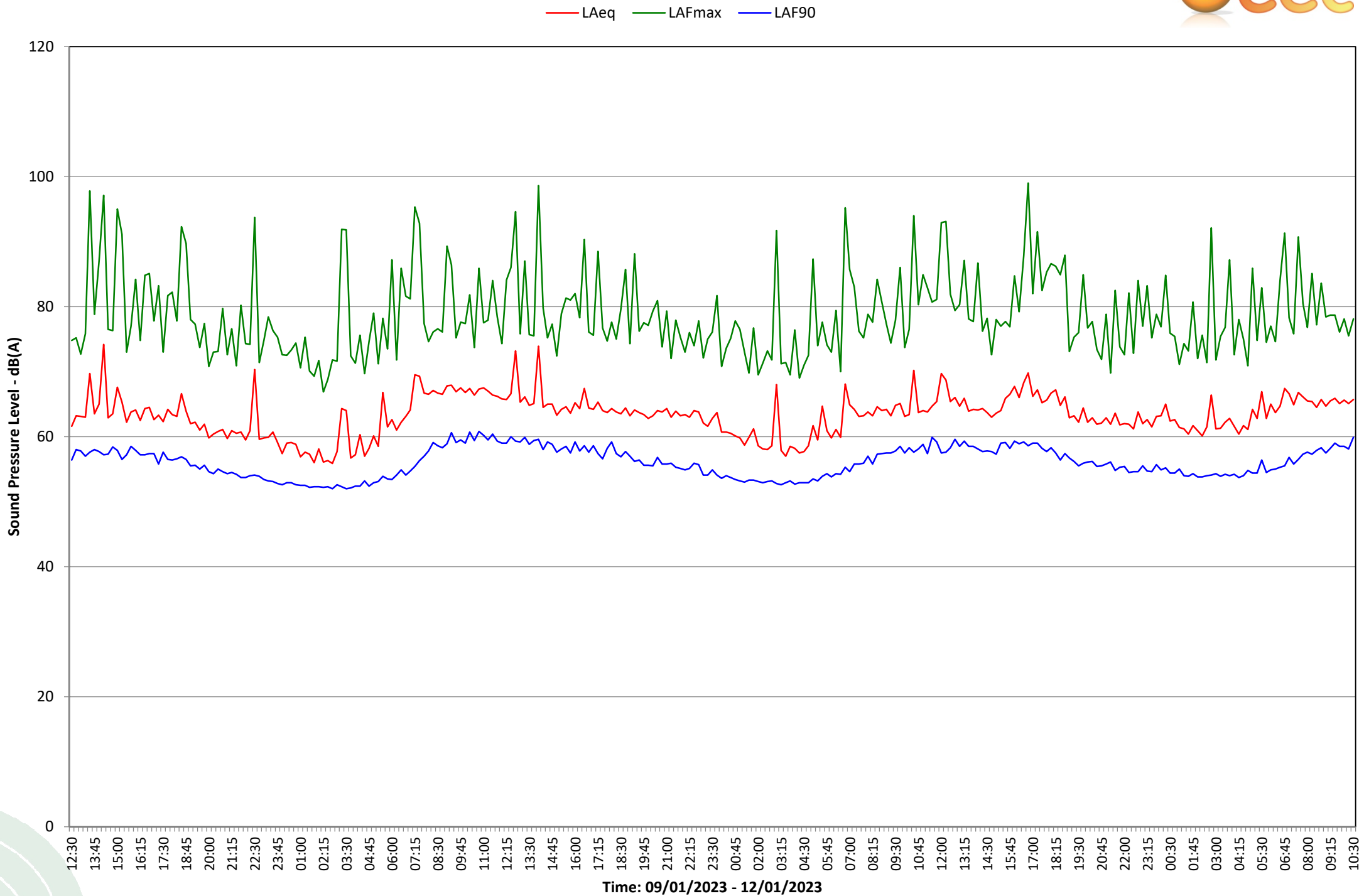
Sheet 3 of 3

Time	L _{Aeq}	L _{AMax}	L _{A90}
12:30	65	82	58
12:45	66	79	60
13:00	65	80	59
13:15	66	87	59
13:30	64	78	59
13:45	64	78	59
14:00	64	87	58
14:15	64	76	58
14:30	64	78	58
14:45	63	73	58
15:00	64	78	57
15:15	64	77	59
15:30	66	78	59
15:45	67	77	58
16:00	68	85	59
16:15	66	79	59
16:30	68	88	59
16:45	70	99	59
17:00	66	82	59
17:15	67	92	59
17:30	65	83	58
17:45	66	85	58
18:00	67	87	58
18:15	67	86	58
18:30	65	85	56
18:45	66	88	57
19:00	63	73	57
19:15	63	75	56
19:30	62	76	56
19:45	64	85	56
20:00	62	77	56
20:15	63	78	56
20:30	62	73	55
20:45	62	72	56
21:00	63	79	56
21:15	62	70	56
21:30	64	83	55
21:45	62	74	55
22:00	62	73	55
22:15	62	82	55
22:30	61	73	55
22:45	64	84	55
23:00	62	77	56
23:15	63	83	55
23:30	62	75	55
23:45	63	79	56
00:00	63	77	55
00:15	65	85	55

Time	L _{Aeq}	L _{AMax}	L _{A90}
00:30	62	76	54
00:45	63	75	54
01:00	61	71	55
01:15	61	74	54
01:30	60	73	54
01:45	62	81	54
02:00	61	72	54
02:15	60	76	54
02:30	62	71	54
02:45	66	92	54
03:00	61	72	54
03:15	61	75	54
03:30	62	77	54
03:45	63	87	54
04:00	62	73	54
04:15	60	78	54
04:30	62	75	54
04:45	61	71	55
05:00	64	86	54
05:15	63	75	54
05:30	67	83	56
05:45	63	75	55
06:00	65	77	55
06:15	64	75	55
06:30	65	84	55
06:45	67	91	56
07:00	67	78	57
07:15	65	76	56
07:30	67	91	57
07:45	66	81	57
08:00	66	77	58
08:15	65	85	57
08:30	65	77	58
08:45	66	84	58
09:00	65	78	58
09:15	66	79	58
09:30	66	79	59
09:45	65	76	59
10:00	66	78	59
10:15	65	76	58
10:30	66	78	60

APPENDIX E
SURVEY RESULTS
(GRAPHICAL)

Noise Level Time History at UCI LMS Small Works - Anatomy Building



APPENDIX F

PUBLISHED PLANT NOISE DATA



FTXM-R / RXM-R

R-32 BLUEVOLUTION

Indoor Units			FTXM20R	FTXM25R	FTXM35R	FTXM42R	FTXM50R	FTXM60R	FTXM71R
Capacity	UK Total Cooling	kW	1.95	2.44	3.32	4.11	4.89	5.86	6.94
	UK Sensible Cooling	kW	1.95	1.73	2.31	2.74	3.55	3.84	4.57
	Nominal Cooling	kW	2.0	2.5	3.4	4.2	5.0	6.0	7.1
	Nominal Heating	kW	2.5	2.8	4.0	5.4	5.8	7.0	8.2
Seasonal Efficiency (EN14825) COOLING	Energy Label		A+++	A+++	A+++	A++	A++	A++	A++
	Pdesign	kW	2.0	2.5	3.4	4.2	5.0	6.0	7.1
	SEER		8.65	8.65	8.65	7.85	7.41	6.90	6.2
	Annual Energy Consumption	kWh	81	101	137	187	236	304	401
Seasonal Efficiency (EN14825) HEATING	Energy Label		A+++	A+++	A+++	A++	A++	A+	A+
	Pdesign	kW	2.3	2.4	2.5	4.0	4.6	4.8	6.2
	SCOP		5.10	5.10	5.10	4.71	4.71	4.30	4.10
	Annual Energy Consumption	kWh	631	659	686	1189	1368	1562	2117
Air Flow Rate (Cooling)	High / Med / Low / Silent	m³/sec	0.175 / 0.125 / 0.095 / 0.072	0.175 / 0.127 / 0.095 / 0.068	0.188 / 0.130 / 0.100 / 0.070	0.198 / 0.150 / 0.108 / 0.072	0.263 / 0.233 / 0.190 / 0.138	0.278 / 0.233 / 0.197 / 0.152	0.282 / 0.250 / 0.203 / 0.167
Dimensions	Height	mm	295	295	295	295	299	299	299
	Width	mm	778	778	778	778	998	998	998
	Depth	mm	272	272	272	272	292	292	292
Weight		kg	10	10	10	10	14.5	14.5	14.5
Sound Pressure (Cooling)	High / Med / Low / Silent	dBA	41 / 33 / 25 / 19	41 / 33 / 25 / 19	45 / 33 / 29 / 19	45 / 39 / 30 / 21	44 / 40 / 36 / 27	46 / 42 / 37 / 30	47 / 43 / 38 / 32
Sound Pressure (Heating)	High / Med / Low / Silent	dBA	39 / 34 / 26 / 20	39 / 34 / 27 / 20	39 / 35 / 28 / 20	45 / 39 / 29 / 21	43 / 39 / 34 / 31	45 / 41 / 36 / 33	46 / 42 / 37 / 34
Sound Power (Cooling)		dBA	57	57	58	60	58	60	60
Outdoor Units			RXM20R9	RXM25R9	RXM35R9	RXM42R	RXM50R	RXM60R	RXM71R
Dimensions	Height x Width x Depth	mm	550 x 765 x 285	550 x 765 x 285	550 x 765 x 285	734 x 870 x 373	734 x 870 x 373	734 x 870 x 373	734 x 954 x 401
Weight		kg	32	32	32	49	49	49	55
Electrical Details	Power Supply		1ph	1ph	1ph	1ph	1ph	1ph	1ph
	Maximum Input Current (MCA)	A	8.93	9.71	9.76	10.36	14.54	15.09	19.78
	Max Fuse Size	A	10	16	16	16	16	16	20
Interconnection Wiring	Core / Cable size		3+E / 1.5	3+E / 1.5	3+E / 1.5	3+E / 1.5	3+E / 1.5	3+E / 1.5	3+E / 1.5
Piping Connections	Liquid / Gas	inches (mm)	1/4 (6.4) / 3/8 (9.5)	1/4 (6.4) / 3/8 (9.5)	1/4 (6.4) / 3/8 (9.5)	1/4 (6.4) / 3/8 (9.5)	1/4 (6.4) / 1/2 (12.7)	1/4 (6.4) / 1/2 (12.7)	1/4 (6.4) / 5/8 (15.9)
Pipework	Maximum Length	m	20	20	20	30	30	30	30
	Maximum Vertical Rise	m	15	15	15	20	20	20	20
	Precharged to	m	10	10	10	10	10	10	10
	Additional Charge	g/m	20	20	20	20	20	20	20
	Holding Charge	kg	0.76	0.76	0.76	1.10	1.15	1.15	1.15
Sound Pressure (Cooling)	Nominal	dBA	46	46	49	48	48	48	47
Sound Pressure (Heating)	Nominal	dBA	47	47	49	48	49	49	48
Sound Power (Cooling)		dBA	59	58	61	62	62	63	66
Operating Range (Cooling)	Min / Max	°CDB	-10 / 50	-10 / 50	-10 / 50	-10 / 50	-10 / 50	-10 / 50	-10 / 46
Operating Range (Heating)	Min / Max	°CWB	-21 / 18	-21 / 18	-21 / 18	-21 / 18	-21 / 18	-21 / 18	-15 / 18
Air Flow Rate (Cooling)	Nominal	m³/sec	0.600	0.472	0.600	0.777	0.777	0.777	0.817
Meets ETL criteria			•	•	•	•	•	•	•

Accessories:

Accessory Ref	Description
EKR521	Wire harness for S21 port for all marked (*) options
BRC073*	Wired remote control - connection cable required
BRCW901A03	3m extension cord required for wired remote controller BRC073
BRCW901A08	8m extension cord required for wired remote controller BRC073
K.CGM	Condensing unit guard (1150 x 1150 x 650)
K.CGS	Condensing unit guard (750 x 1150 x 460)
K.CWB90-2	Wall bracket (90kg, 500mm support arm)
K.DT1	Condensate drip tray for use with K.CWB90-2
KLIC-DDV3*	KNX interface for Split type systems
KRP413A15*	Adaptor PCB for remote on/off control - constant/pulse contact
KRP928A25*	Adaptor PCB for interface to Daikin centralised control systems
RTD-RA*	Adaptor PCB for Modbus connection and/or extended system functions

Notes & Features:

- All fan coils are supplied with infrared remote controller ARC466A67 (7-day schedule timer)
- All fan coils have auto restart after power failure
- Wired controller, KLIC-DI and RTD-RA options cannot be combined
- Night set mode
- Air purification using Flash Streamer technology
- Presence sensor and 2-area intelligent eye
- 5 fan speeds can be selected; from high to super low
- Heat boost function to reach set point quicker during start-up
- Can be connected with R410A Mini VRV using BPMK boxes
- RXM20-35R9 can reduce the sound power by a further 6 dB(A)

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