

Sound Licensing Ltd.
Suite 4, Broxbourne Business Centre
New River Trading Estate
Cheshunt
Herts EN8 ONL

T: +44 (0) 20 7096 1555
www.soundlicensing.co.uk
enquiries@soundlicensing.co.uk

NOISE IMPACT ASSESSMENT REPORT – CONDENSING UNITS

40 GRAY'S INN ROAD, HOLBORN WC1X 8LR

FOR

MR K RAZA



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AUTHOR: L ANKERS, AMIOA
CHECKED: M LAUEZZARI, MIOA MIOL
APPROVED: M LAUEZZARI, MIOA MIOL

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1. EXECUTIVE SUMMARY

The Client intends to seek planning approval (Retrospective) for the installation of mechanical plant (3 No. Condensing Units) to service the premises at 40 Gray's Inn, Holborn WC1X 8LR.

Sound Licensing has undertaken an environmental noise survey at the site in order to determine the operational noise levels of the mechanical plant & prevailing background noise levels that are representative of the nearest noise sensitive properties, which have been identified as the second-floor residential premises above the site 40 Gray's Inn Road, WC1X.

The results of the noise survey are considered reasonable given the location of the measurement position and the existing noise sources in the local vicinity.

Noise measurements and calculations of the mechanical plant have been undertaken using all available details and plans provided by the client and obtaining manufacturers' specifications wherever possible. The data and information form the basis of the assessment.

Noise break-out limits for the mechanical plant have been proposed based on the methodologies of British Standard (BS) 4142:2014+A1:2019 and in accordance to Local Authority policy. A robust, worst-case assessment of the noise levels associated to the proposed mechanical plant has been undertaken.

In accordance with BS 4142:2014+A1:2019 guidance, the measured and predicted noise impact due to the operation of the mechanical plant, with recommended mitigation installed, ***"is an indication of the specific sound source having a low impact"***. The predicted noise level of the mechanical plant at the nearest noise sensitive properties is considered to comply with the London Borough of Camden Council's policy.

2. INTRODUCTION

The client has installed three (3 No.) new condensing units at the rear of 40 Gray's Inn, Holborn WC1X 8LR, the noise from which could have the potential to affect existing noise sensitive properties nearby.

The purposes of this report are:

- To determine prevailing environmental noise levels affecting surrounding properties due to nearby noise sources (e.g. road traffic, aircraft etc);
- Based on the above, to present noise emission limits in accordance with the requirements of BS 4142:2014+A1:2019 and Local Authority policy, and
- To undertake an assessment to demonstrate compliance with the Local Authority noise requirements.

3. SITE DESCRIPTION

Planning permission (Retrospective) is being sought for the installation of three (3 No.) condensing units at 40 Gray's Inn, Holborn WC1X 8LR (hereafter referred to as 'the site'). The property is a traditionally built four-storey terraced building with a basement in the London Borough of Camden. It is located in a mixed area comprising predominantly of commercial units at ground floor level with residential accommodation on the floors above.

The nearest sensitive residential receptors were noted to be the second-floor windows located on the rear façade of 40 Gray's Inn Road at approximate distances of 5, 6 and 7m from the existing condensing units.

The nearest sensitive receptors are identified in figure 3.1. If the noise impact assessment details that there is an indication of the specific sound source having a low impact at these premises then it can be safely assumed it will be met at other properties of equal distance and/or those further away.

Figure 3.1 shows the site highlighted in **blue** with the nearest noise sensitive premises highlighted in **red**.

Figure 3.1 **Site Location and Surrounding Land Use**



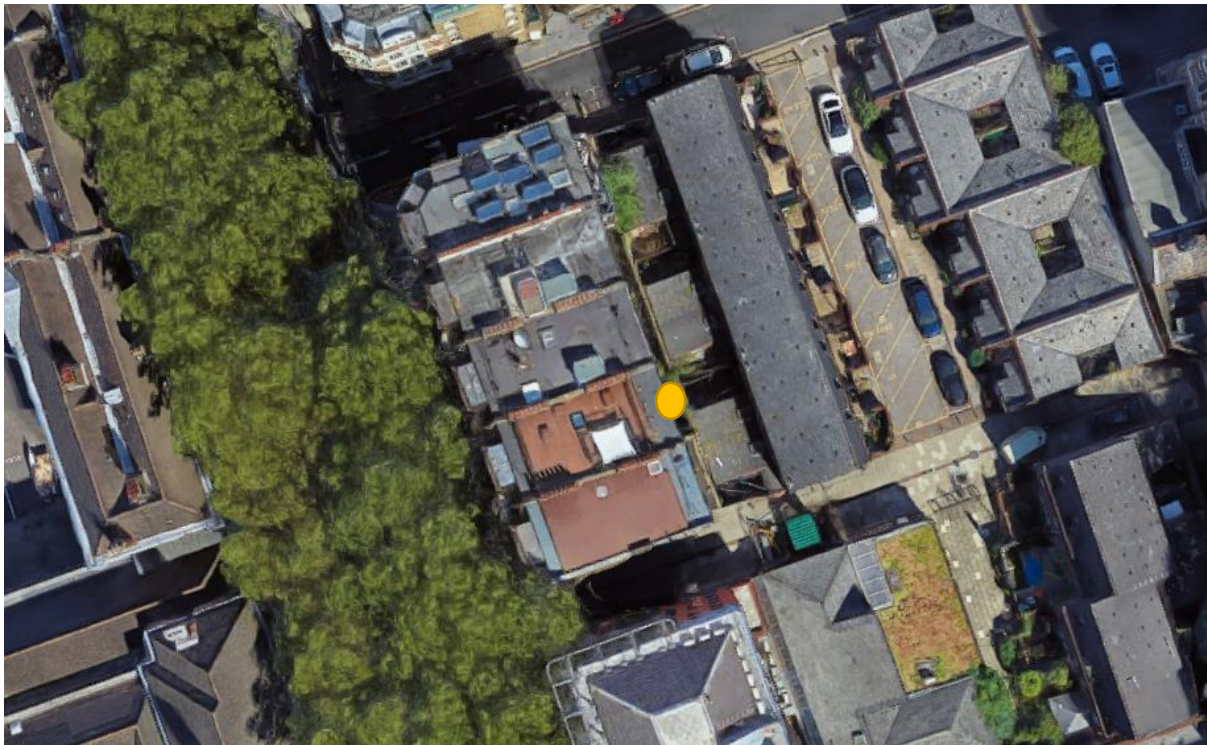
Source: Google Maps

4. ENVIRONMENTAL NOISE SURVEY METHODOLOGY

An unmanned environmental noise survey was undertaken at a single measurement location at ground floor level to the rear of the site. The survey was undertaken between 12:00 hours on the 16th March and 12:00 hours on the 18th March 2022. A survey at this time covers the most sensitive period of time in which the mechanical plant system may be operational. It was agreed with the operator of the premises that all of the mechanical plant would be switched off during the night-time period.

Ambient, background and maximum noise levels (L_{Aeq} , L_{A90} and L_{Amax} respectively) were measured throughout the noise survey in continuous 15-minute periods. The approximate measurement position is indicated in orange on Figure 4.1 below.

Figure 4.1 Site Plan Showing Approximate Location of Measurement Position



Source: Google Maps

The sound level meter microphone was positioned on a tripod at a height of 4.5 metres, 1 metre from the rear façade of the building at ground floor level. The position is not considered to be in free-field and therefore a 3dB façade correction will be applied. The monitoring position is considered representative of background noise levels at the nearest identified noise sensitive properties. The monitoring position was chosen for equipment security reasons also.

The equipment used for the noise survey is summarised in Table 4.1.

Table 4.1 Description of Equipment used for Noise Survey

Equipment	Description	Quantity	Serial Number
Larson Davis Sound Expert LxT	Type 1 automated logging sound level meter	1	0004720
Larson Davis 377B02	½" microphone	1	159605
Larson Davis	Pre-amplifier	1	042612
Larson Davis CAL200	Class 1 Calibrator	1	11706

The noise survey and measurements were conducted in accordance with BS7445-1:2003 '*Description and measurement of environmental noise. Guide to quantities and procedures*'.

Weather conditions throughout the entire noise survey period were noted to be mild (approx. 1-15° Celsius), passing clouds (30 to 50% cloud cover approximately) with a light wind (<5m/s). These weather conditions were checked against and confirmed by the use of the Met Office mobile application available on smart phone technology. These conditions were maintained throughout the majority of the survey period and are considered reasonable for undertaking environmental noise measurements.

The noise monitoring equipment was field calibrated before and after the noise survey period. No significant drift was recorded (± 0.3 dB). Equipment calibration certificates can be provided upon request.

5. NOISE SURVEY RESULTS AND OBSERVATIONS

5.1 Results

A summary of the measured ambient and background noise levels during the proposed operational hours are shown in Table 5.1 below (full monitoring data can be found in Appendix C). The mechanical plant was not in operation during the following time-periods.

Table 5.1 Measured Ambient and Typical Background Sound Pressure Levels

Date / Period (hours)	Ambient Sound Pressure Level, dB $L_{Aeq,15min}$	Typical Background Sound Pressure Level, dB $L_{A90,15min}$
17/03/2022(00:15 to 06:15)	40-43*	39*
18/03/2022(01:15 to 07:00)	41-47*	39*

*Façade correction -3dB

The typical background noise level at the measurement position during the survey, at the time in which the plant could be operational, is **39dB** $L_{A90,15min}$.

5.2 Observations

Given that the noise survey was unmanned, noise sources could not be identified. However, at the beginning and end of the survey background noise was dominated by noise from the vehicles on the local road network and existing mechanical plant. After analysis of the data no significant abnormal noise source(s) were identifiable. It is considered that the measured noise levels are reasonable given the location of the measurement position.

6. EXTERNAL NOISE EMISSION LIMITS

6.1 Local Authority Requirements

The site lies within the jurisdiction of the Local Authority, Camden Borough Council. The following requirements for commercial plant have previously been requested by the Local Authority:

“Where appropriate and within the scope of the document it is expected that British Standard 4142:2014 ‘Methods for rating and assessing industrial and commercial sound’ (BS 4142) will be used. For such cases a ‘Rating Level’ of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion.”

For the purposes of this report, an assessment has been undertaken in line with BS 4142:2014+A1:2019. A design criterion of achieving a minimum 10dB(A) below the typical background noise level has been adopted in line with the Local Authorities policy. Taking the noise monitoring data in Section 5 and Local Authority requirements above, the following design target has been adopted for mechanical plant as provided in Table 6.1.

Table 6.1 Maximum Noise Emission Design Target at Residential Premises

Date / Period (hours)	Typical Background Sound Pressure Level, dB $L_{A90,15min}$	Rating Noise Level at Nearest Residential Facade, dB $L_{Ar,T}$
17/03/2022(00:15 to 06:15)	39*	29
18/03/2022(01:15 to 07:00)	39*	

* Façade correction -3dB.

6.2 BS 4142:2014+A1:2019

BS 4142:2014+A1:2019 "Methods for rating and assessing industrial and commercial sound" presents a method for assessing the significance and possible adverse impact due to an industrial noise source, based on a comparison of the source noise levels and the background noise levels, both of which are measured or predicted at a noise sensitive receiver e.g. a residential property.

The specific noise level due to the source is determined, with a series of corrections for tonality, impulsivity, intermittency or other unusual characteristic. The rating level is then compared to the background noise level and the significance of the new noise source likelihood of any adverse impact is determined in accordance with the following advice:

"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 occur. A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context. 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. 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."

7. EXISTING MECHANICAL PLANT AND ASSOCIATED NOISE LEVELS

The following items of plant are installed at the rear of the premises.

Table 7.0 Existing Condensing Units

External Plant Item	Quantity	Make	Model	Measured Noise Level* $L_{p(A)}$
Condensing Units	3	Marstair	MRC80 1/50/230	70dB @ 1m (All Units)

*Reference sound pressure levels. Manufacturer's specifications are provided in Appendix B.

In reference to section 6 of this report, a penalty addition (+3dB) has been applied for intermittency as the system will be switched on & off as and when required. Penalty additions have not been applied for tonality as manufacturers' data shows no significant characteristics, or for impulsiveness as it is considered that these characteristics will not be perceptible sufficient to attract attention at the noise receptors. Penalty additions have not been applied for any other sound characteristics as mechanical plant of this type generally do not demonstrate such features.

Due to the placement of the units, there are reflective surfaces that will cause an increase to the sound pressure level at the nearest noise sensitive receptor. Therefore, corrections for reflections have been applied to the predicted noise assessment at the nearest sensitive receptor. Full calculations can be found in Appendix D.

8. NOISE IMPACT ASSESSMENT

This section presents calculations to predict the noise impact of the condensing units, located at the site, at the nearest noise sensitive properties.

8.1 Operational Hours and Background Noise Levels

The condensing units will operate as required 24 hours-a-day, 7 days-a-week.

The typical background noise level at the measurement position during the survey is **39dB** $L_{A90,15min}$. The design range is **29dB** $L_{Ar,T}$ at the façade of the nearest residential premises.

8.2 Nearest Noise Sensitive Properties

The nearest sensitive residential receptors were noted to be the second-floor windows located on the rear façade of 40 Gray's Inn Road at approximate distances of 5, 6 and 7m from the existing condensing units.

8.3 Description of Calculation Process

In accordance with the methodologies of BS 4142:2014+A1:2019, calculations have been undertaken to predict noise levels in which the condensing units could be operational at their maximum level. Given the distances between the noise sources and the noise sensitive receptors, point source calculations have been used.

8.4 Noise Level Predictions

Calculations to determine the noise of the condensing units operating at the facade of the residential property is given below. Full calculations are provided in Appendix D.

The measured rating noise level at the second floor window, with the mechanical plant operating, is calculated to be **57dB** $L_{Ar,T}$ which is **18dB(A) above** the typical night-time background noise level (39dB $L_{A90, 1hour}$).

The predicted rating noise level at the second floor window, with the mechanical plant operating, is calculated to be **57dB** $L_{Ar,T}$ which is **18dB(A) above** the typical night-time background noise level (39dB $L_{A90, 1hour}$).

In accordance with BS 4142:2014+A1:2019 guidance, noise from the mechanical plant ***“is an indication of the specific sound source having a significant adverse impact”***. *The lower the rating level is relative to the measured background level, the less likely it is that the specific sound source will have an adverse impact.*

In order to meet the required design target, it is recommended that the following mitigation measures are implemented:

8.5 Recommended Noise Mitigation

It is recommended to install permanent acoustic enclosures around the condensing units. The enclosure should provide a minimum insertion loss of 28dB Rw.

The rating noise level at the nearest residential façade, with the mechanical plant operating, with recommended mitigation installed, is predicted to be **29dB L_{Ar,T}** which is **10dB(A) below** the lowest background noise level (39dB L_{A90, 15min}).

In accordance with BS 4142:2014+A1:2019 guidance, the rating noise, with the recommended mitigation measures installed, ***“is an indication of the specific sound source having a low impact”***. *The lower the rating level is relative to the measured background level, the less likely it is that the specific sound source will have an adverse impact.*

8.6 Vibration

In addition to the control of airborne noise transfer, it is important to consider the transfer of noise as vibration to adjacent properties as well as any sensitive areas of the same building. Vibration from the system is not expected, however, as a precaution plant should wherever possible be installed on suitable type isolators.

Uncertainty

The levels of uncertainty in the data and calculations are considered to be low/medium given the robust exercise undertaken in noise monitoring and the confidence in the data statistical analysis. Manufacturers' data for the plant is highly likely to be robust. Detailed calculations and resultant noise levels at the residential location are considered to be confidently predicted.

9. CONCLUSION

Sound Licensing has undertaken an environmental noise survey at the site in order to determine operational noise levels of the mechanical plant & prevailing background noise levels that are representative of the nearest noise sensitive properties. The operation of the condensing units, in accordance with BS 4142:2014+A1:2019 guidance, with recommended noise mitigation installed, indicates to creating a low impact. All worst-case scenarios have been applied to the assessment. The predicted cumulative operating noise level of the condensing units is demonstrated to comply with the London Borough of Camden Council's policy.

APPENDIX A – Acoustic Terminology

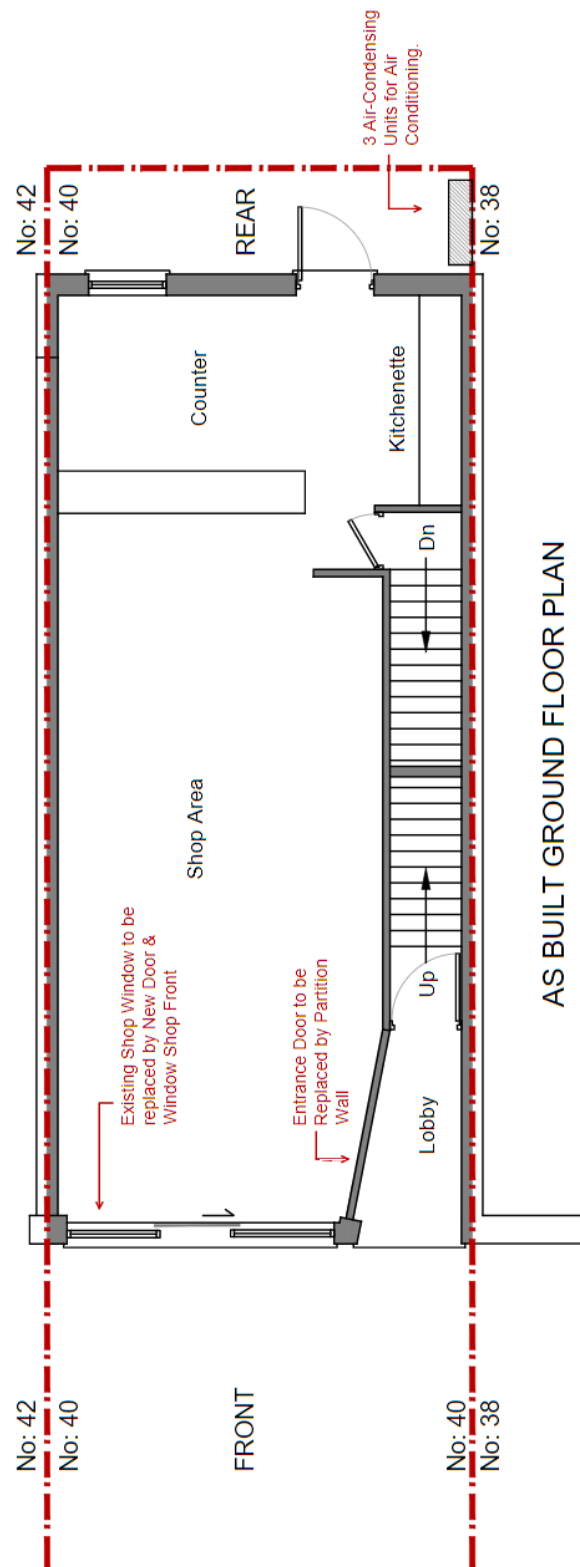
Parameter	Description
Acoustic environment	Sound from all sound sources as modified by the environment
Ambient sound	Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far
Ambient sound level, $L_a = LA_{eq,T}$	Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T
Background sound level, $LA_{90,T}$	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels
Decibel (dB)	A logarithmic scale representing the sound pressure or power level relative to the threshold of hearing (20×10^{-6} Pascals).
Equivalent continuous A-weighted sound pressure level, $LA_{eq,T}$	Value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, $T = t_2 - t_1$, has the same mean-squared sound pressure as a sound that varies with time
Measurement time interval, T_m	Total time over which measurements are taken
Rating level, $L_{Ar,Tr}$	Specific sound level plus any adjustment for the characteristic features of the sound
Reference time interval, T_r	Specified interval over which the specific sound level is determined
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
Residual sound level, $L_r = LA_{eq,T}$	Equivalent continuous A-weighted sound pressure level of the residual sound at the assessment location over a given time interval, T
Specific sound level, $L_s = LA_{eq,Tr}$	Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r
Specific sound source	Sound source being assessed

References:

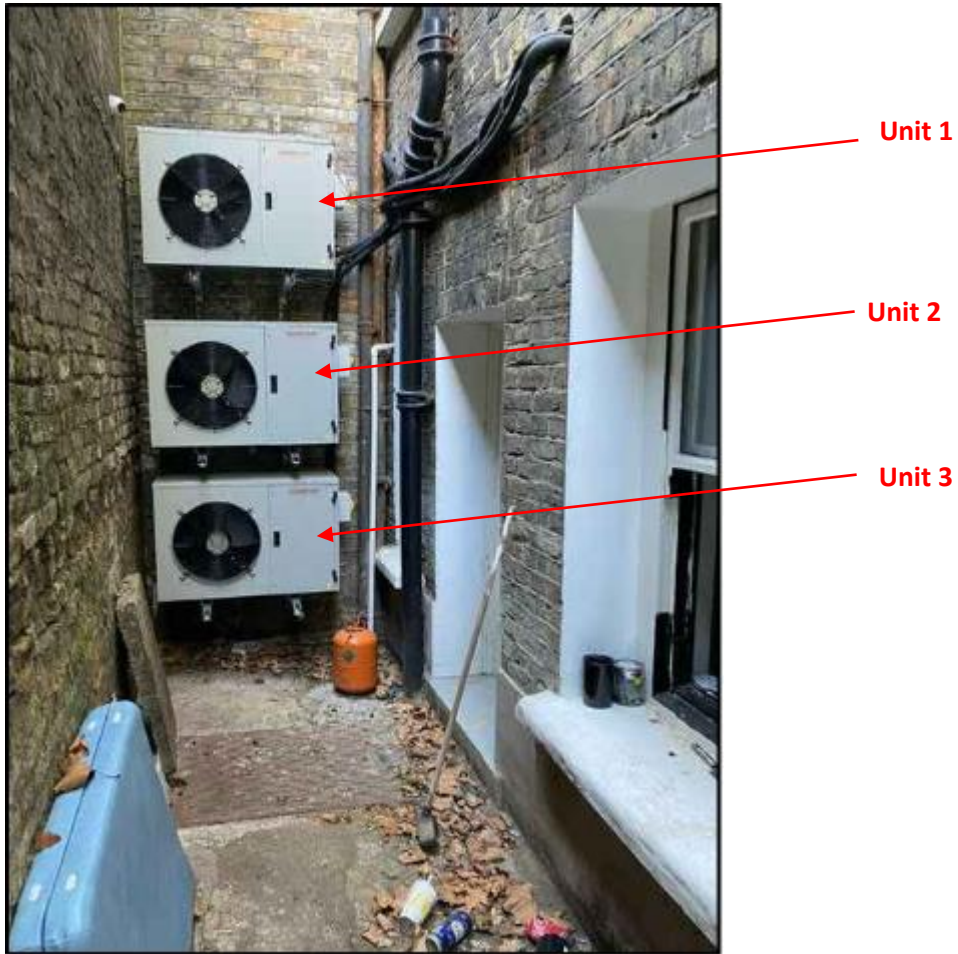
BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'

APPENDIX B – Data Sheets and Figures

Existing Ground Floor Plan



Location of Condensing Units



Marstair MRC80 1/50/230 Data Sheet



- THE MRC RANGE INCORPORATES 5MM TUBES WITHIN THE HEAT EXCHANGERS GIVING A LARGE REDUCTION IN THE AMOUNT OF REFRIGERANT REQUIRED.
- APPROVED FOR USE WITH NEW LOW GWP REFRIGERANTS R448A & R449A
- LARGE RANGE OF SINGLE PHASE MODELS
- ECA LISTED MRC+
- ECO DESIGN READY



MRC Range

The Marstair range of refrigeration condensing units are an effective cooling solution for food display cabinets and many other refrigeration applications designed specifically for outdoor use.

Standard equipment for all models includes; HP/LP switch for system protection, 3 minute start delay timer and fan speed head pressure control for operation in low-ambient temperatures.

This quiet, efficient and wide range of units will operate free standing or wall mounted.



Additional MRC+ Features

- 5 Year Warranty (parts only)
- A-grade quality components, with one size fits all spares
- Compact Units
- Incorporates 5mm tubes within the heat exchanger
- Green Heat Ready
- Tier II ECO-Design
- Large range of single phase models
- Also available in a large Low Temp range (MRC+LT)
- Bespoke packages
- 3 minute start delay timer
- Fan speed head pressure control
- Compressor jacket and noise attenuation insulation
- BS EN 60947-3-1 isolator
- Sight glass
- Refrigeration filter/drier and HP/LP switch
- New low GWP refrigerants approved
- Also available in Ducted range (DRC+)

The MRC+ range is also now ECA Listed.

The low temperature range, MRC+ LT, is also available with all the benefits of the MRC+ range.

Marstair MRC80 1/50/230 Acoustic Data

Dimensions and Weights Unpacked Units

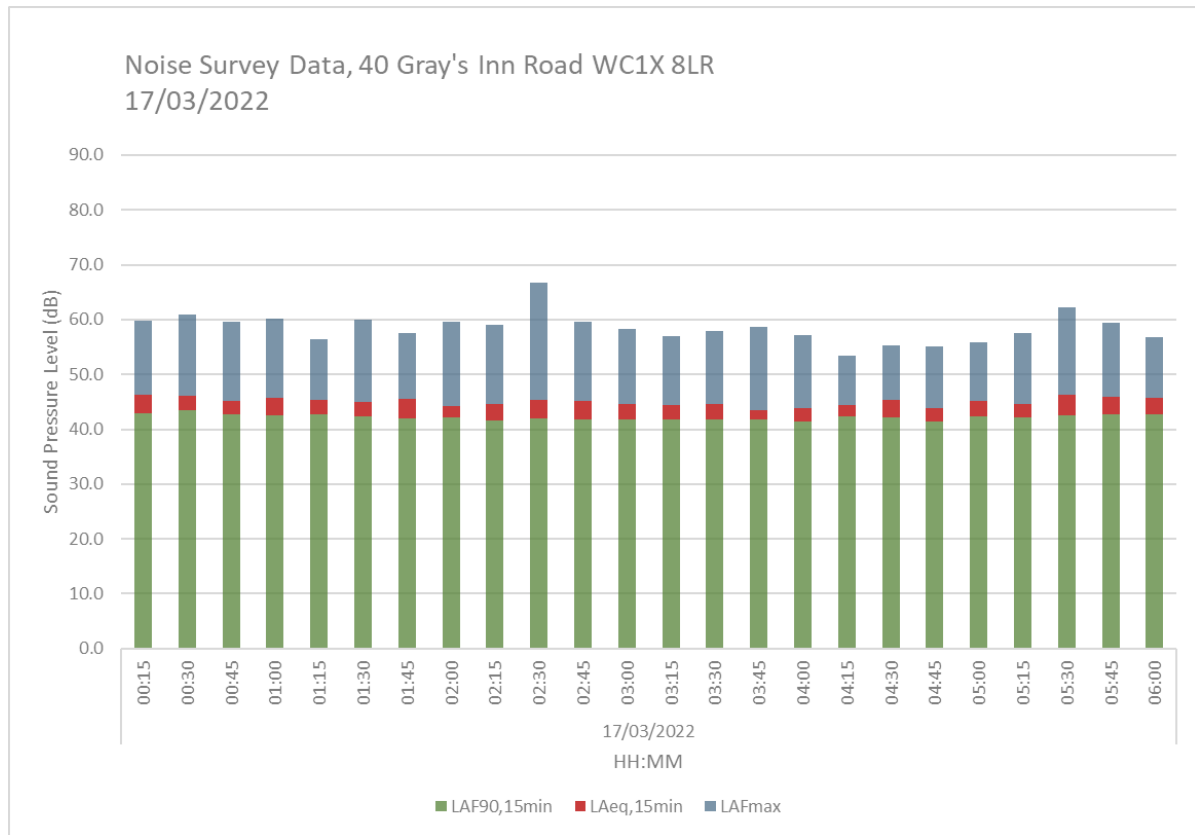
	MODEL													
	15	20	30	40	45	50	60	80	90	100	130	150	165	180
HEIGHT mm	620	620	620	620	720	720	720	720	820	820	1080	1050	1080	1275
WIDTH mm	900	900	900	900	1000	1000	1000	1000	1000	1000	1000	1000	1000	1100
DEPTH mm	300	300	300	300	350	350	350	350	350	350	425	425	425	425
1 Ph kg	46	47	48	53	60	64	65	66	76	84	-	107	-	-
3 Ph kg	-	-	48	53	-	62	63	64	73	81	101	103	103	118

MRC+ Sound Levels

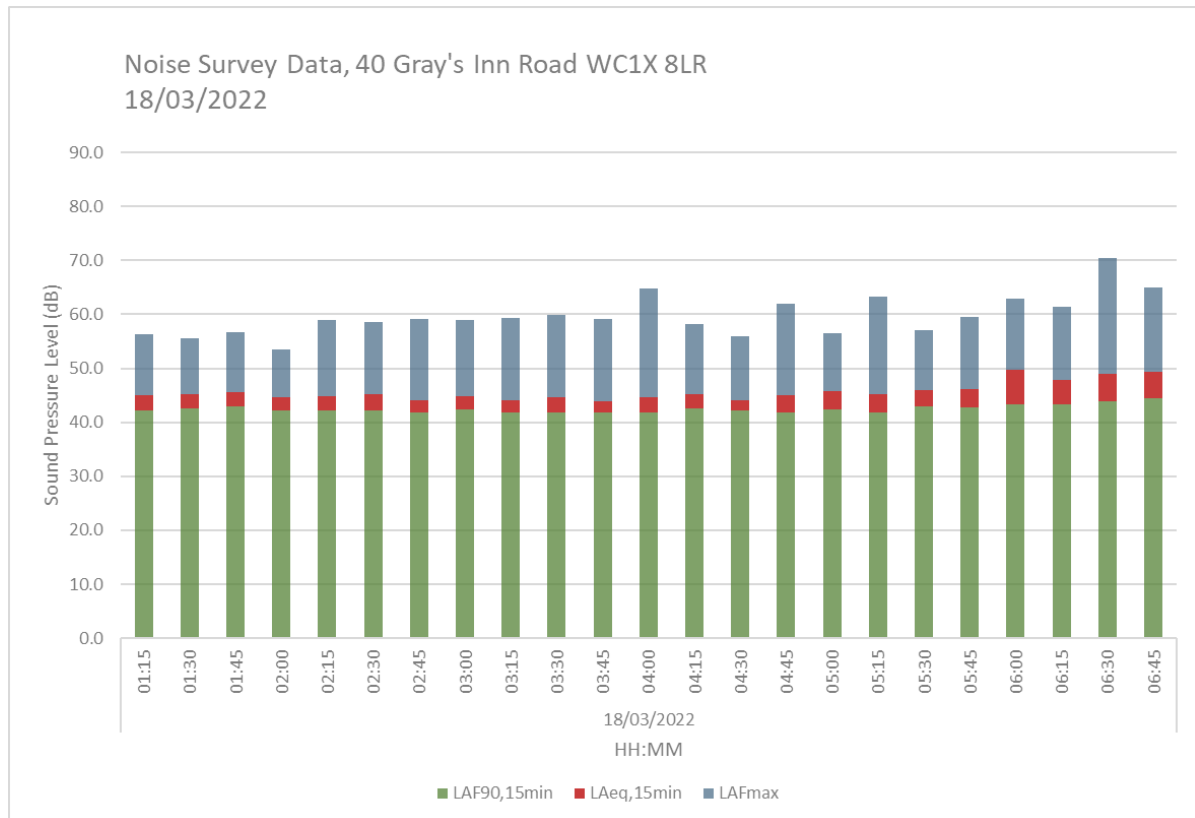
Sound pressure levels (SPL) at 10m distance in free field conditions @ 27°C External Ambient

dBA	34	34	34	34	33	33	33	34	37	38	37	37	37	39
NR	28	28	28	28	27	27	27	27	30	31	30	30	30	32

APPENDIX C – Noise monitoring Data



Date	Time	L _{Aeq,15min}	L _{AFmax}	L _{AF90,15min}
17/03/2022	00:15	46.2	59.7	43.0
	00:30	46.2	61.0	43.4
	00:45	45.2	59.7	42.8
	01:00	45.8	60.3	42.5
	01:15	45.3	56.4	42.7
	01:30	44.9	60.0	42.3
	01:45	45.5	57.5	42.0
	02:00	44.3	59.5	42.1
	02:15	44.6	59.0	41.6
	02:30	45.4	66.7	42.0
	02:45	45.2	59.6	41.7
	03:00	44.6	58.4	41.7
	03:15	44.5	56.9	41.7
	03:30	44.6	57.9	41.8
	03:45	43.4	58.7	41.7
	04:00	43.9	57.1	41.4
	04:15	44.5	53.4	42.4
	04:30	45.3	55.2	42.2
	04:45	43.9	55.1	41.5
	05:00	45.2	55.9	42.4
	05:15	44.6	57.5	42.1
	05:30	46.2	62.3	42.6
	05:45	45.9	59.4	42.8
	06:00	45.8	56.7	42.8



Date	Time	L _{Aeq,15min}	L _{AFmax}	L _{AF90,15min}
18/03/2022	01:15	45.1	56.3	42.2
	01:30	45.2	55.5	42.5
	01:45	45.5	56.7	42.9
	02:00	44.6	53.5	42.1
	02:15	44.8	58.9	42.2
	02:30	45.2	58.5	42.1
	02:45	44.1	59.2	41.9
	03:00	44.9	59.0	42.3
	03:15	44.1	59.2	41.8
	03:30	44.6	59.8	41.9
	03:45	43.9	59.1	41.9
	04:00	44.7	64.7	41.8
	04:15	45.2	58.3	42.6
	04:30	44.1	55.9	42.1
	04:45	45.0	61.9	41.8
	05:00	45.8	56.4	42.4
	05:15	45.2	63.3	41.9
	05:30	45.9	57.0	43.0
	05:45	46.2	59.5	42.8
	06:00	49.8	62.9	43.4
	06:15	47.9	61.3	43.3
	06:30	48.9	70.5	43.9
	06:45	49.4	64.9	44.4

APPENDIX D – Calculations

Measured Sound Pressure Level

Level distance given a LPA @ a distance (Assumes point source and Hemispherical)
(Pressure Calculations)

LPA = dB at distance of metre

dB level at metres = dB

Formula = $L_{PA1} = L_{PA2} - 20 \log (d_1/d_2)$

Measure Sound Pressure Level @ Nearest Sensitive Receptor + Intermittency (3dB) = 57dB $L_{Aeq,T}$

Predicted Sound Pressure Level

Level distance given a LPA @ a distance (Assumes point source and Hemispherical)
(Pressure Calculations)

LPA = dB at distance of metre

dB level at metres = dB

Formula = $L_{PA1} = L_{PA2} - 20 \log (d_1/d_2)$

Unit 1 Sound Pressure Level @ 5m + Reflections (9dB) = 49dB $L_{Aeq,T}$

Level distance given a LPA @ a distance (Assumes point source and Hemispherical)
(Pressure Calculations)

LPA = dB at distance of metre

dB level at metres = dB

Formula = $L_{PA1} = L_{PA2} - 20 \log (d_1/d_2)$

Unit 2 Sound Pressure Level @ 6m + Reflections (12dB) = 50dB $L_{Aeq,T}$

Level distance given a LPA @ a distance (Assumes point source and Hemispherical)

(Pressure Calculations)

LPA = dB at distance of metre

dB level at metres = dB

Formula = $L_{PA1} = L_{PA2} - 20 \log (d_1/d_2)$

Unit 2 Sound Pressure Level @ 7m + Reflections (12dB) = 49dB $L_{Aeq,T}$

Adding dB

Levels to be added (Max. of eight)

Enter values	<input type="text" value="49"/>	<input type="text" value="50"/>	<input type="text" value="49"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
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Total = dB

Cumulative Sound Pressure Level @ Nearest Sensitive Receptor + Intermittency (3dB) = 57 dB $L_{Aeq,T}$