

The Co-operative
Bedhampton Road
Havant
PO9 3PT

**Plant Noise
Impact Assessment**

On behalf of



Project Reference: 88660 | Revision: 01 | Date: 29th July 2019
Revised: 19th June 2020

Document Information

Project Name : The Co-operative, Bedhampton, Belmont Grove
Project Reference : 88660
Report Title : Plant Noise Impact Assessment
Doc Reference : 88660/NIA
Date : 29th July 2019

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For and on behalf of Noise Solutions Ltd				

Revision	Date	Description	Prepared	Reviewed/ Approved
01	19 Jun 2020	Plant amended. Noise spectrum data included	NAC	JS

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Executive Summary

Noise Solutions Ltd (NSL) has been commissioned by RPM to provide a noise impact assessment of new plant serving a proposed Co-op Store located between Belmont Grove and Bedhampton Road in Bedhampton.

The results of the assessment demonstrate that cumulative plant noise emissions from the selected external plant will comply with the proposed limits.

Noise from the proposed fixed plant should not be a reason for refusal of planning permission.

1.0 Introduction

- 1.1. Noise Solutions Ltd (NSL) has been commissioned by RPM to provide a noise impact assessment for noise emissions for plant serving a proposed Co-operative store located between Bedhampton Road and Belmont Grove in Bedhampton.
- 1.2. An environmental sound survey has been undertaken to establish the prevailing background sound pressure levels at a location representative of the sound levels outside the nearest noise sensitive receptors to the site.
- 1.3. This report contains a noise impact assessment based on project information available at the time of writing and the results of a baseline noise survey.
- 1.4. To assist with the understanding of this report a glossary of acoustic terms can be found in [Appendix A](#). An in-depth glossary of acoustic terms can be viewed online at www.acoustic-glossary.co.uk.

2.0 Details of development proposals

- 2.1. The building is currently occupied by a restaurant. It is understood that the new Co-op unit will occupy the whole of the building.
- 2.2. It is proposed to locate the refrigeration and air conditioning plant in an external plant area at the rear, northern side of the store. The proposed plant layout is shown in [Appendix D](#). Plant noise data is given in [0](#).
- 2.3. The air conditioning units will operate only when the store is trading; refrigeration plant will operate at all times.

3.0 Nearest noise sensitive receptors

- 3.1. The area surrounding the site is predominantly residential in nature. The nearest noise sensitive property to the plant location is 39 Belmont Grove, approximately 11m away from the proposed plant area. It is understood that the flat above the store is to be removed.
- 3.2. A site plan showing the site and surrounding area, the nearest noise sensitive properties and noise monitoring location used in this assessment is presented in [Appendix B](#).

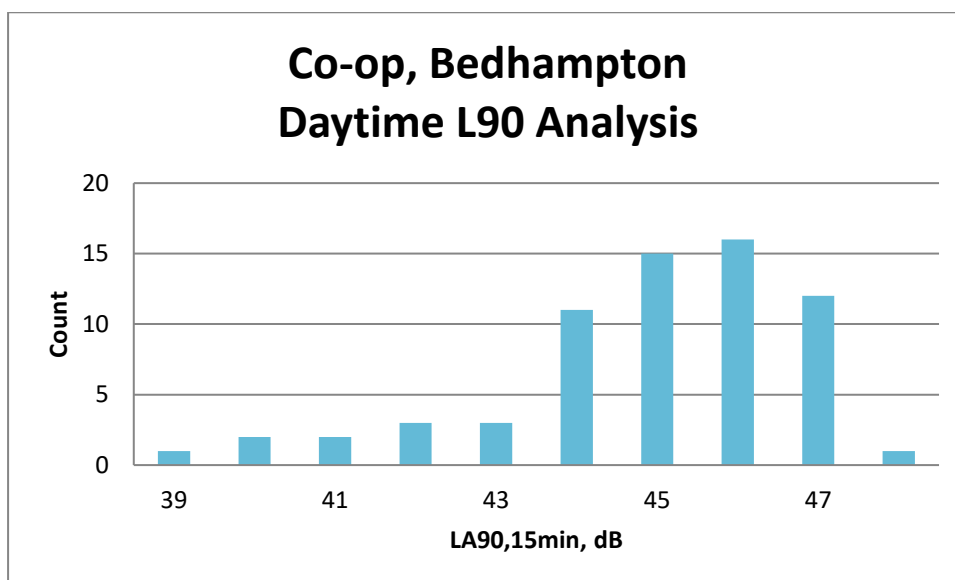
4.0 Existing noise climate

- 4.1. An environmental noise survey was undertaken to establish the typical background sound levels at a location representative of the noise climate outside the façades of the nearest noise sensitive receptors to the proposed plant area during the quietest times at which the plant will operate.
- 4.2. The results of the environmental sound survey are summarised in Table 1 below. The full set of measurement results and details of the survey methodology are presented in [Appendix C](#).

Table 1 Summary of survey results

Measurement period	Range of recorded sound pressure levels (dB)			
	L _{Aeq} (15mins)	L _{AFmax} (15mins)	L _{A10} (15mins)	L _{A90} (15mins)
Daytime (07.00 – 23.00 hours)	46-67	65-94	48-61	39-48
Night-time (23.00 – 07.00 hours)	33-54	46-79	34-57	28-44

Figure 1 Histogram of daytime L_{A90} background sound pressure levels



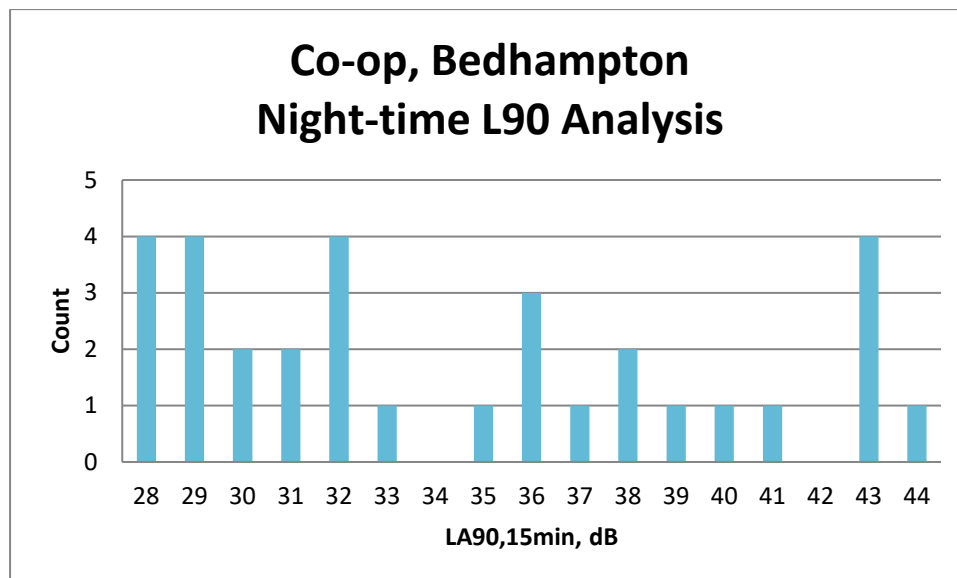
- 4.3. Further statistical analysis has been carried out on the data, and the mean and median values are shown in table 2 below.

Table 2 Statistical analysis of L_{A90,15min} levels during the daytime period

dB, L _{A90} daytime period	
mean	45
modal	45
median	46

- 4.4. In order to be robust, 42dB has been selected to be representative of the background noise level during the daytime period.

Figure 2 Histogram of night-time L_{A90} background sound pressure levels



- 4.5. Further statistical analysis has been carried out on the data and the mean and median values are shown in table 3 below.

Table 3 Statistical analysis of $L_{A90,15min}$ levels during the night-time period

dB, L_{A90} night-time period	
mean	34
modal	32
median	32

- 4.6. The lowest recorded value of 28dB(A) has been selected to be representative of the background sound level in the area.
- 4.7. Therefore, the following values are considered representative of the existing background sound pressure levels at nearby noise sensitive premises:
- 42dB L_{A90} during the daytime period; and
 - 28dB L_{A90} during the night-time period

5.0 Plant noise design criteria

Havant Borough Council

- 5.1. Correspondence with Mark Moss from Havant Borough Council confirmed that they normally expect a noise assessment to be carried out in accordance with the methodology as outlined in BS 4142:2014.

BS 4142:2014 Methods for rating and assessing industrial and commercial sound

- 5.2. BS 4142:2014 is intended to be used to assess the likely effects of sound on people residing in nearby dwellings. The scope of BS 4142:2014 includes *"sound from fixed plant installations which comprise mechanical and electrical plant and equipment"*.
- 5.3. The procedure contained in BS 4142:2014 is to quantify the *"specific sound level"*, which is the measured or predicted level of sound from the source in question over a one hour period for the daytime and a 15 minute period for the night-time. Daytime is defined in the standard as 07:00 to 23:00 hours, and night-time as 23:00 to 07:00 hours.
- 5.4. The specific sound level is converted to a rating level by adding penalties on a sliding scale to account for either potentially tonal or impulsive elements. The standard sets out objective methods for determining the presence of tones or impulsive elements, but notes that it is acceptable to subjectively determine these effects.
- 5.5. The penalty for tonal elements is between 0dB and 6dB, and the standard notes: *"Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible."*
- 5.6. The penalty for impulsive elements is between 0dB and 9dB, and the standard notes: *"Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible."*
- 5.7. The assessment outcome results from a comparison of the rating level with the background sound level. The standard states:
- *Typically, the greater this difference, the greater the magnitude of the impact.*
 - *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.*
- 5.8. The standard does state that "adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."
- 5.9. The standard goes on to note that: "Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night."
- 5.10. In addition to the margin by which the Rating Level of the specific sound source exceeds the Background Sound Level, the 2014 edition places emphasis upon an appreciation of the context, as follows:
- "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."*
- 5.11. BS 4142:2014 requires uncertainties in the assessment to be considered, and where the uncertainty is likely to affect the outcome of the assessment, steps should be taken to reduce the uncertainty.

Proposed criteria

- 5.12. In order that noise from new plant should have, at worst, a "low impact" according to the method in BS 4142:2014, the plant noise limits in Table 4 are proposed. Due to the exceptionally low background levels, 30dB has been selected to be the criteria during the night-time period. (An external level of 30dB will result in an internal noise level of 15dBA with windows partially open. This is well below the levels normally produced by domestic refrigerators etc.)

Table 4 Plant noise emissions limits at residences

Period	Cumulative plant noise rating level, dB(A)
Daytime (07.00 – 23.00 hours)	42
Night-time (23.00 – 07.00 hours)	30

- 5.13. The above limits have not been approved by the local authority at this stage

6.0 Plant noise impact assessment

- 6.1. The cumulative plant noise level at the most affected noise sensitive receptors has been predicted. The assessment has considered the directivity of sound propagation, and distance losses between the plant and the receiver. In order to be robust, a 3dB feature correction has been added to the plant items.
- 6.2. The predictions have been based on the proposed plant operating at full capacity during the day and with the refrigeration plant operating at night-time duty when the store is closed.
- 6.3. It should be noted that the proposed plant is not anticipated to exhibit any tonal or impulsive characteristics provided it is well maintained. All proposed external plant will be inverter driven and, therefore, will gently ramp up and down depending on the demands on the various systems.
- 6.4. Table 5 summarises the results of the assessment at the most affected residential property. All other nearby receptors benefit from increased distance or screening to the plant. The full set of calculations can be found in [Appendix F](#).

Table 5: Assessment of predicted noise levels at Receptor

Receptor	Period	Predicted rating level at receptor, L_{Aeq} (dB)	Proposed design criterion (dB)	Difference (dB)
R1	Daytime (07.00 – 23.00 hours)	39	42	-3
	Night-time (23:00 – 07:00 hours)	28	30	-2

- 6.5. The plant noise impact assessment has demonstrated that cumulative noise emissions from the proposed plant will comply with normally accepted proposed criteria as noted in 5.12 above. It should also be noted that the night-time rating level is below the representative background noise level.
- 6.6. As BS 4142:2014 advises, the impact must be considered within the context of the site and the surrounding acoustic environment. The following must, therefore, also be taken into consideration when determining the potential impact that may be experienced:
- The assessment is undertaken at the nearest residential windows. The impact on all other nearby residential windows will be lower due to distance attenuation.
 - It should be noted that the above assessment is based on the worst case in terms of plant noise emissions. Predictions are based on the plant operating simultaneously at maximum daytime and night-time duty. As the systems are inverter driven, this situation will not typically occur except for in very high ambient temperatures (i.e. peak summer conditions). It

must be noted that background noise levels will typically be higher during the times when the plant is likely to operate at a higher duty. Therefore, the assessment is considered robust.

6.7. Where possible, uncertainty in this assessment has been minimised by taking the following steps:

- The measurement of the background sound levels was undertaken at a location within close proximity to the nearest noise sensitive receptors, with comparable distance and screening to local noise sources.
- The meter and calibrator used have a traceable laboratory calibration and the meter was field calibrated before and after the measurements.
- Uncertainty in the calculated impact has been reduced by the use of a well-established calculation method.

6.8. All reasonable steps have been taken to robustly assess noise from the proposed plant.

7.0 Summary

- 7.1. Noise Solutions Ltd has been commissioned by RPM to provide guidance on the maximum noise emissions for plant serving a proposed Co-operative store located between Belmont Grove in Bedhampton.
- 7.2. An assessment of predicted noise levels has demonstrated that plant noise emissions will be at or below the existing background sound level at the nearest noise-sensitive premises and should therefore be acceptable to Havant Borough Council.
- 7.3. Therefore, noise from the plant area should not be a reason for refusal of planning permission.

Appendix A Acoustic terminology

Parameter	Description
Ambient Noise Level	The totally encompassing sound in a given situation at a given time, usually composed of a sound from many sources both distant and near ($L_{Aeq,T}$).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s_1 and s_2 is given by $20 \log_{10}(s_1/s_2)$. The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is $20\mu\text{Pa}$. The threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.
dB(A), L_{Ax}	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).
Fast Time Weighting	Setting on sound level meter, denoted by a subscript F, that determines the speed at which the instrument responds to changes in the amplitude of any measured signal. The fast time weighting can lead to higher values than the slow time weighting when rapidly changing signals are measured. The average time constant for the fast response setting is 0.125 (1/8) seconds.
Free-field	Sound pressure level measured outside, far away from reflecting surfaces (except the ground), usually taken to mean at least 3.5 metres
Façade	Sound pressure level measured at a distance of 1 metre in front of a large sound reflecting object such as a building façade.
$L_{Aeq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level recorded during a noise event with a period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise. $L_{A10,18h}$ is the A-weighted arithmetic average of the 18 hourly $L_{A10,1h}$ values from 06:00-24:00.
$L_{90,T}$	A noise level index. The noise level that is exceeded for 90% of the measurement time interval, T. It gives an indication of the lower levels of fluctuating noise. It is often used to describe the background noise level and can be considered to be the "average minimum" noise level and is a term used to describe the level to which non-specific noise falls during quiet spells, when there is lull in passing traffic for example.

Appendix B Aerial photograph site showing areas of interest



Appendix C Environmental sound survey

Details of sound surveys

- C.1 Measurements of the existing background sound levels were undertaken between 13.30 hours on Tuesday 2nd July and 14.14 hours on Wednesday 3rd July 2019.
- C.2 The sound level meter was programmed to record the A-weighted L_{eq} , L_{90} , L_{10} and L_{max} noise indices for consecutive 15-minute sample periods for the duration of the noise survey.

Measurement position

- C.3 The representative measurement position was located on a lamppost on Belmont Grove in an area representative of the nearest noise sensitive receptor (location indicated on the site plan in [Appendix B](#)).
- C.4 In accordance with BS 7445-2:1991 '*Description and measurement of environmental noise – Part 2: Guide to the acquisition of data pertinent to land use*', the measurements were undertaken under free-field conditions.

Equipment

- C.5 Details of the equipment used during the survey are provided in the table below. The sound level meter was calibrated before and after the survey; no significant change (+/-0.2 dB) in the calibration level was noted.

Environmental noise survey

Description	Model / serial no.	Calibration date	Calibration certificate no.
Class 1 Sound level meter	Svantek 977 / 36190	06/07/2018	15444
Condenser microphone	ACO Pacific 7052E / 57366		
Preamplifier	Svantek SV12L / 41504		
Calibrator	CEL 284/2 /4/03326334	06/07/2018	15443

Weather Conditions

- C.6 Weather conditions were determined both at the start and on completion of the survey. It is considered that the meteorological conditions were appropriate for environmental noise measurements. The table below presents the weather conditions recorded on site at the beginning and end of the survey.

Weather Conditions				
Measurement Location	Date/Time	Description	Beginning of Survey	End of Survey
As indicated on Appendix B	13:30 02/07/2019 – 14:15 03/07/2019	Temperature (°C)	23	22
Cloud Cover Symbol Scale in oktas (eighths) 0 Sky completely clear 1 2 3 4 Sky half cloudy 5 6 7 8 Sky completely cloudy (9) Sky obstructed from view		Precipitation:	No	No
		Cloud cover (oktas - see guide)	2	6
		Presence of fog/snow/ice	No	No
		Presence of damp roads/wet ground	No	No
		Wind Speed (m/s)	Light breeze	Light breeze
		Wind Direction	-	-
		Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	No	No

Results

- C.7 The results of the environmental survey are considered to be representative of the background sound pressure levels at the façades of the nearest noise sensitive receptors during the quietest times at which the plant will operate. The noise climate during the survey period was dominated by distant traffic noise. The results of the survey are presented in a time history graph overleaf.

Co-op, Bedhampton Tuesday 02 - Wednesday 03 Jul 2019



PLANT AREA (SECTION "A") @ 1:50

STORE PLAN OVERVIEW (NTS)

SECTION "A"

HUBBARD LOW NOISE C02 REFRIGERATION COMPRESSOR PACK

KELVION GAS COOLER - GF-SA103F5H-063M038 (WITH 750 LEGS)

MITSUBISHI A/C OUTDOOR UNIT (PUZ-ZM125YKA) WITH VERTICAL AIR DEFLECTORS

REFRIGERATION PACK SELECTION											
HA1	Pack Refrigerant:	8744	Manufacturer:	Hubbard	Integrated Receiver Size:			60.08L	Pack Details		
Compressor Reference	Compressor Model	Compressor Manufacturer	New/Exist	ST	Evap Capacity (kW)	TWH (kW)	Design current (Alpha)	Pull load Current (A@24V)	Electrical Connection	Length (mm)	Width (mm)
HA1	4MTL-07X (INV)	Copeland	New	-7	12.30	39.30	14.22	17.50			
HA2	4MTL-07X	Copeland	New	-7	12.30	39.00	12.48	17.50			
HA3	4MTL-07X	Copeland	New	-7	12.30	39.00	12.48	17.50	415v/3ph/50hz	2250	885
HT TOTALS					36.40	57.30	39.18	52.50			
PACK TOTALS					36.40	57.30	39.18	52.50			
Pressure Relief Valves (Height):										120.00 bar	
Pressure Relief Valves (Sum):										60.00 bar	

GAS COOLER SELECTION											
Reference	Model	Manufacturer	New / Existing	Refrigerant	Gas Outlet / Ambient Temperature (°C)	TD (K)	Trink (kW)	Current (A)	Ø (mm)	Full Load Current (per fan) (A)	Supply Voltage & Phase
GA	GF-SA103F5H-063M038	Kelvion	New	R744	97 / 33	2	59.30		Ø 3	0.2	400V/ 3Ph/ 50Hz

AIR CONDITIONING - SELECTION DETAILS											
Room (Ref-Fix)	Model	Make	New/Existing	Type	Refrigerant	Position	Duty: Cooling (kW)	Duty: Heating (kW)	MCR Rating	Running Current (Max Current)	Electrical Connections
ACU-1	PUZ-ZM125YKA	Mitsubishi	New	Outdoor Unit	R32	Plant	-	-	16	5.32	380-415v/3Ph/50Hz
ACU-2	PUZ-ZM125YKA	Mitsubishi	New	Outdoor Unit	R32	Plant	-	-	16	5.32	380-415v/3Ph/50Hz
ACU-3	PUZ-ZM125YKA	Mitsubishi	New	Outdoor Unit	R32	Plant	-	-	16	5.32	380-415v/3Ph/50Hz

RDM Sizing											
Room (Ref-Fix)	Model	Make	New/Existing	Type	Refrigerant	Position	Duty: Cooling (kW)	Duty: Heating (kW)	MCR Rating	Running Current (Max Current)	Electrical Connections
ACU-1	PUZ-ZM125YKA	Mitsubishi	New	Outdoor Unit	R32	Plant	-	-	16	5.32	380-415v/3Ph/50Hz
ACU-2	PUZ-ZM125YKA	Mitsubishi	New	Outdoor Unit	R32	Plant	-	-	16	5.32	380-415v/3Ph/50Hz
ACU-3	PUZ-ZM125YKA	Mitsubishi	New	Outdoor Unit	R32	Plant	-	-	16	5.32	380-415v/3Ph/50Hz

PACK DETAILS											
Room (Ref-Fix)	Model	Make	New/Existing	Type	Refrigerant	Position	Duty: Cooling (kW)	Duty: Heating (kW)	MCR Rating	Running Current (Max Current)	Electrical Connections
ACU-1	PUZ-ZM125YKA	Mitsubishi	New	Outdoor Unit	R32	Plant	-	-	16	5.32	380-415v/3Ph/50Hz
ACU-2	PUZ-ZM125YKA	Mitsubishi	New	Outdoor Unit	R32	Plant	-	-	16	5.32	380-415v/3Ph/50Hz
ACU-3	PUZ-ZM125YKA	Mitsubishi	New	Outdoor Unit	R32	Plant	-	-	16	5.32	380-415v/3Ph/50Hz

RDM Sizing											
Room (Ref-Fix)	Model	Make	New/Existing	Type	Refrigerant	Position	Duty: Cooling (kW)	Duty: Heating (kW)	MCR Rating	Running Current (Max Current)	Electrical Connections
ACU-1	PUZ-ZM125YKA	Mitsubishi	New	Outdoor Unit	R32	Plant	-	-	16	5.32	380-415v/3Ph/50Hz
ACU-2	PUZ-ZM125YKA	Mitsubishi	New	Outdoor Unit	R32	Plant	-	-	16	5.32	380-415v/3Ph/50Hz
ACU-3	PUZ-Z										

Appendix E Manufacturer's plant noise data

Plant Ref	Manufacturer / Model	Operating Hours	Sound pressure level
HA1 Refrigeration pack	Hubbard Refrigeration Pack	Daytime and night-time	20dBA at 10m
GA Gas Cooler	Kelvion/GF-SA103F5H-063M038	Daytime and night-time	22dBA at 10m
ACU-1, ACU-2, ACU-3 Air conditioning units	Mitsubishi/PUZ-ZM125YKA	Daytime only	52dBA at 1m (each)

Octave band sound data

			Octave band centre frequency (Hz)							
			63	125	250	500	1000	2000	4000	8000
Gas Cooler	Kelvion/GF-SA103F5H-063M038	Sound power level, dB		58	53	49	49	46	42	34
AC Units	Mitsubishi/PUZ-ZM125YKA	Sound pressure level at 1m (dB)	62	55	53	50	47	42	38	30

Note: No manufacturer's octave band data is published for refrigeration pack

Plant noise to Receptor R1 Daytime

Plant noise to Receptor R1 Night-time

Plant	Maximum plant noise level at source		DISTANCE		DIRECTIVITY Correction (dB)	SCREENING Correction (dB)	BS4142:2014 Penalty	RESULTANT AT RECEPTOR (dB)
	Noise level (dBA)	Distance (m)	Distance (m)	Correction (dB)				
Pack	20	10	11	-1	0	0	3	22
Gas Cooler	22	10	11	-1	3	0	3	27
Total rating level at receptor (Night-time)								28