



4193

Rating of Industrial Noise affecting Mixed Industrial and Residential Areas

British Standard 4142:1997

Site Name: Rose Green

Address: 68 Rose Green, Bognor Regis,
West Sussex, PO21 3EQ.

Customer Name: DCI Refrigeration

Address: Warrior Business Centre,
Fitzherbert Road,
Farlington, Portsmouth, PO6 1TX.

SUBSTITUTION

8-5-14



KR Associates (UK) Ltd

Unit 2, Vancouver Wharf,
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Consultant: Mr. J. D. Earwood



4133

Accredited to:
ISO/IEC 17025:2005**Schedule of Accreditation**

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Material / Products Tested	Type of Tests / Properties Measured / Range of measurements	Standard specification/ Equipment/Techniques used	Location Code
Building Elements Partitions, walls, Roofs & facades	Field measurements of airborne sound insulation i.e. Level difference and related factors	The Building Regulations 2010 Approved Document E:2003 (Incorporating 2004 & 2010 amendments)	Any suitable customer site
Floors	Field measurement of impact sound insulation i.e. Impact Sound Pressure Level and related factors	The Building Regulations 2010 Approved Document E:2003 (Incorporating 2004 & 2010 amendments)	Any suitable customer site
Environmental Noise	Method for Rating industrial noise affecting mixed residential and industrial areas	BS 4142:1997	Any suitable customer site
Buildings	Building Air Leakage Tests	BS EN 13829:2001 ATTMA Technical Standard 1:2007	Any suitable customer site
Dwellings Non-dwellings	Building Air Leakage Tests	ATTMA TSL1:2010 ATTMA TSL2:2010	Any suitable customer site

Version Control

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KR03715 v1.3 (Full)	14 th May 2014	Full revision of plant and assessment	Mr. J. D. Earwood

Declaration

This report has been prepared in line with the relevant test procedure and the scope of accreditation issued to KR Associates (UK) Ltd by the United Kingdom Accreditation Services on 25th May 2012. The report has been checked and released for issue by the relevant Technical Authority of KR Associates (UK) Ltd.


 Mr. R. M. Scrivener, MSc, MICA



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1 EXECUTIVE SUMMARY

1.1 Instruction

KR Associates (UK) Ltd have been instructed by DCI Refrigeration to undertake an environmental noise survey at the proposed store at 68 Rose Green, Bognor Regis, West Sussex to support the planning application for the proposed refrigeration and air conditioning equipment.

1.2 Scope of Report

British Standard 4142:1997 details the method for rating the noise of an industrial nature from proposed source and is based on the margin by which it exceeds a background noise level to determine if complaints are likely to be received.

1.3 Summary of Results (UKAS)

1.3.1 Rating Levels

British Standard 4142:1997	Day Time	Night Time
Section 8	07:00 – 23:00	23:00 – 07:00
Rating Noise Levels	Level exceeds 33 dB	Level exceeds 33 dB

1.3.2 Background Noise Levels

British Standard 4142:1997	Day Time	Night Time
Section 7	07:00 – 23:00	23:00 – 07:00
Background Noise Levels	Level exceeds 48 dB	Level exceeds 48 dB

1.3.3 BS4142:1997 Assessment

British Standard 4142:1997	Day Time	Night Time
Section 9	07:00 – 23:00	23:00 – 07:00
Assessment	-15	-5
Likelihood of Complaints	below 'Complaints Unlikely'	below 'Complaints Marginal'

1.4 Conclusions

1.4.1 British Standard 4142:1997

The British Standard 4142:1997 assessments, which are covered by the KR Associates (UK) Ltd scope of accreditation from the United Kingdom Accreditation Service ("UKAS"), indicates that the proposed plant will be unlikely to give rise to complaints from local residents.

1.4.2 Impact on Local Amenity

The additional assessments, which are not covered by the KR Associates (UK) Ltd scope of accreditation from UKAS, indicate that there is unlikely to be an adverse impact in terms of noise on the local residential properties.



2 TEST PROCEDURE

2.1 Scope of Report

This report sets out to determine if the installation of 2 no Gunter Evaporators associated with the operation of the store will result in noise levels that will have a detrimental effect on the local residents or be likely to give rise to complaints in the future.

2.2 Scope of BS 4142:1997

In the assessment of the proposed plant, consideration has been given to the scope of British Standard 4142:1997, which in section 1, details the lower limits for the rating and background noise levels:

"The method is not suitable for assessing the noise....when the background and rating noise are both very low....

Note. For the purposes of this standard, background noise levels below 30 dB and rating levels below 35 dB are considered to be very low."

It is considered that both the background noise levels and the rating noise levels fall within the scope of British Standard 4142:1997.

2.3 Specific Noise Levels

2.3.1 Assessment Position

The assessment position was established as the rear of the residential property adjacent to the site located a minimum of 7.3m from the proposed refrigeration sources within the dedicated plant area to the rear of the site.

2.3.2 Manufacturers Data

As the proposed refrigeration and air conditioning equipment has yet to be installed the sound power levels, established in accordance with British Standard 13487: 2003, were used to calculate the specific noise levels. A copy of test certificates for the plant equipment is detailed in Appendix D.

2.3.3 Calculations

The specific noise levels are calculated at the assessment position located at the residential property adjacent to the site using the calculations detailed within ISO 9613 Part 1 and 2: 1996. These calculations take the manufacturers sound power levels, account for a variety of factors including source directivity, distance, atmospheric absorption, ground absorption and the effects of any barriers and determine the resultant noise levels at the assessment position.



2.4 Background Noise Levels

2.4.1 Assessment Position

In line with the requirements of British Standard 4142:1997 the background noise levels should be measured at the assessment position. As access was not available at the assessment position, measurements were made at an equivalent position instead.

2.4.2 Equivalent Position

The background noise levels were measured at the equivalent position located on a lamp post on Lincoln Ave between 17/03/2014 and 18/03/2014. Whilst this position was not ideal (being adjacent to a side road), measurements could not be made at the rear of the site due to the operation of the existing plant. As the background levels could be expected to be higher at the background position used, a noise map has been produced (see Appendix D) to normalise the predicted levels used in this calculation.

2.5 Rating Levels (Character Correction)

A character correction of +5 dB is added to the specific noise level to establish the rating level if any of the following is present at the assessment position.

BS4142:1997 – Section 8.2 Character Correction		Unlikely to be audible to local residents	Correction
Distinguishable, Discrete Continuous Noise	Whine	Unlikely to be audible or present	+0 dB
	Hiss	Unlikely to be audible or present	
	Screech	Unlikely to be audible or present	
	Hum	Unlikely to be audible or present	
Distinguishable Impulses	Bangs	Unlikely to be audible or present	+0 dB
	Clicks	Unlikely to be audible or present	
	Clatters	Unlikely to be audible or present	
	Thumps	Unlikely to be audible or present	
Irregularity attracting attention		Unlikely to be audible or present	+0 dB

The source level is likely to be inaudible at the assessment position as it is at least 10 dB(A) below the corresponding background noise level measured using the same measurement index.

Noise Levels	Day Time	Night Time
Time Period	22:00 – 23:00	02:00 – 03:00
Minimum Background Noise Levels	Over 1 hour 50 dB	Over 2 hours 34 dB
Maximum Specific Noise Levels	Over 1 hour 30 dB	Over 2 hours 31 dB



2.6 Assessment and Conclusion

The rating level is subtracted from the background level to determine the assessment level during the day time and night time periods. The assessment level is then compared against one of the three distinct categories within British Standard 4142:1997 to determine the likelihood of complaints from the proposed plant.



3 CRITERIA

3.1 BS4142:1997

British Standard 4142:1997 defines 3 distinct categories based on the calculated assessment level:

"A difference of around +10 dB or more indicates that complaints are likely.

A difference of around +5dB is of marginal significance.

If the rating level is more than 10 dB below the measured background level then there is a positive indication that complaints are unlikely."

In determining a suitable criteria care needs to be taken to ensure an "unreasonable burden" is not placed on the proposed development and that the rating and background levels fall within the scope of British Standard 4142:1997.

3.2 National Planning Policy Framework ("NPPF")

The National Planning Policy Framework sets out the Government's planning policies for England and how these are expected to be applied. In reference to noise in the environment, paragraph 123 states:

"Planning Policies and decisions should aim to:

Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;

Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;

Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established..."

3.3 Noise Policy Statement for England ("NPSE")

The Noise Policy Statement for England provides the following guidance:

SOAEL – Significant Observed Adverse Effect Level: This is the level above which significant adverse effects on health and quality of life occur...

Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of the Government policy on sustainable development."



3.4 Local Authority Criteria

KR Associates (UK) Ltd contacted Chichester District Council (East Pallant House, 1 East Pallant, Chichester, West Sussex, PO19 1TY) to determine if there any specific noise criteria to be used when considering the application for the proposed plant.

3.4.1 Day Time Criteria

It is expected that the Local Authority will at this site require a criteria of -5 dB during the night time period

3.4.2 Night Time Criteria

It is expected that the Local Authority will at this site require a criteria of -5 dB during the night time period



4 CALCULATION OF LEVELS AT ASSESSMENT POSITION

4.1 Maximum Sound Power Levels – BS EN 13487:2003

4.1.1 Day Time Levels – 07:00 to 23:00

Sound Power Levels BS EN ISO 13487:2003	Octave Band Centre Frequency (Hz)							Sum (A)	Units
	63	125	250	500	1000	2000	4000		
Gunter Evaporator	78.0	73.0	63.0	55.0	55.0	53.0	50.0	62.5	dB
Gunter Evaporator	83.0	78.0	68.0	60.0	60.0	58.0	55.0	67.5	dB
Sound Power Levels, L _w , BS EN ISO 13487:2003. Reference 1 x 10 ⁻¹² watts.									

4.1.2 Night Time Levels – 23:00 to 07:00

Sound Power Levels BS EN ISO 13487:2003	Octave Band Centre Frequency (Hz)							Sum (A)	Units
	63	125	250	500	1000	2000	4000		
Gunter Evaporator	78.0	73.0	63.0	55.0	55.0	53.0	50.0	62.5	dB
Gunter Evaporator	83.0	78.0	68.0	60.0	60.0	58.0	55.0	67.5	dB
Sound Power Levels, L _w , BS EN ISO 13487:2003. Reference 1 x 10 ⁻¹² watts.									

4.2 Calculations - ISO 9613:1996

4.2.1 Source Directivity (D_c)

A correction is made to account for the location of the source and the effect of additional reflective surfaces excluding the ground and is contained within section 6 of ISO 9613 - Part 2:1996.

Number of Surfaces	Correction in dB (D _c)
No Reflective Surfaces	+0 dB
1 Reflective Surface	+3 dB
2 Reflective Surfaces	+6 dB
3 Reflective Surfaces	+9 dB

4.2.2 Geometric Divergence (A_{div})

A correction is made for the distance between the source and assessment position using the following formula defined in section 7.1 of ISO 9613-Part 2:1996.

Formula	Symbols
$A_{div} = 20 \cdot \log_{10} \{ d/d_0 \} + 11$	A_{div} = Reduction due to Geometric Divergence (dB) d = Distance from source to receiver (m) d_0 = reference distance (1m)

4.2.3 Ground Absorption (A_{gr})

A correction is made for the effect of the ground between the source and receiver depending on whether it is considered hard or soft ground.

Type of ground	Correction in dB (A_{gr})
Hard Ground	+ 3 dB
Soft Ground	+ 0 dB

4.2.4 Atmospheric Absorption (A_{atm})

As the source was less than 100m from the receiver position (assessment position) no correction was made for atmospheric absorption.

4.2.5 Barrier Effect (A_{bar})

A correction is made for any barrier in the direct line of site between the source and the assessment position and is detailed in section 7.4 of ISO 9613-Part 2:1996. For clarity the K_{met} meteorological correction has been ignored and C_2 equals 40 and C_3 equals 1.

Formula	Symbols
$A_{bar} = 10 \cdot \log_{10} [3 + (40 \cdot \delta / \lambda) - A_g]$ *Note1 where $\delta = a + b - r$ and $\lambda = c / f$	A_{bar} = Effective barrier attenuation (dB) A_g = Total Ground Absorption (dB) *Note 1: Only apply the A_{gr} correction if $A_{gr} > 0$ δ = Path difference (m) a = Distance from source to barrier head (m) b = Distance from barrier head to assessment position (m) r = Distance from source to assessment position (m) λ = Wavelength of sound (m) c = Speed of sound – Assumed to be 342 ms ⁻¹ f = Octave band centre frequency (Hz)



4.3 Day Time Calculations (07:00 to 23:00)

4.3.1 Source 1 – (Gunter Evaporator)

Gunter Evaporator	Octave Band Centre Frequency (Hz)							Sum (A)	Units
	63	125	250	500	1000	2000	4000		
Sound Power Levels (L_w)	78.0	71.0	63.0	55.0	55.0	53.0	50.0	62.5	dB
Directivity (D_d)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	dB
Geometric Divergence (A_{gd})	-29.4	-29.4	-29.4	-29.4	-29.4	-29.4	-29.4	—	dB
Atmospheric Absorption (A_{atm})	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	dB
Ground Absorption (A_g)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	dB
Barrier Correction (A_{bc})	-4.9	-4.9	-5.1	-5.4	-6.0	-6.9	-8.3	—	dB
Resultant Noise Levels (L_{r1})	43.7	38.7	28.5	25.2	19.6	16.7	12.3	27	dB

L_w - Sound Power Levels, L_w BS EN ISO 13487:2003. Reference 1×10^{-12} watts. L_p - Sound Pressure Levels. Reference 2×10^{-5} Nm⁻²

4.3.2 Source 2 – (Gunter Evaporator)

Gunter Evaporator	Octave Band Centre Frequency (Hz)							Sum (A)	Units
	63	125	250	500	1000	2000	4000		
Sound Power Levels (L_w)	83.0	78.0	58.0	60.0	60.0	58.0	55.0	67.5	dB
Directivity (D_d)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	dB
Geometric Divergence (A_{gd})	-28.2	-28.2	-28.2	-28.2	-28.2	-28.2	-28.2	—	dB
Atmospheric Absorption (A_{atm})	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	dB
Ground Absorption (A_g)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	dB
Barrier Correction (A_{bc})	-5.6	-6.2	-7.3	-8.9	-10.9	-13.4	-16.1	—	dB
Resultant Noise Levels (L_{r2})	49.2	43.6	32.5	22.9	20.9	16.4	10.7	31	dB

L_w - Sound Power Levels, L_w BS EN ISO 13487:2003. Reference 1×10^{-12} watts. L_p - Sound Pressure Levels. Reference 2×10^{-5} Nm⁻²

4.4 Night Time Calculations (23:00 to 07:00)

4.4.1 Source 1 – (Gunter Evaporator)

Gunter Evaporator	Octave Band Centre Frequency (Hz)							Sum (A)	Units
	63	125	250	500	1000	2000	4000		
Sound Power Levels (L_w)	78.0	73.0	63.0	55.0	55.0	53.0	50.0	62.5	dB
Directivity (D_e)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	dB
Geometric Divergence (A_{div})	-29.4	-29.4	-29.4	-29.4	-29.4	-29.4	-29.4	—	dB
Atmospheric Absorption (A_{atm})	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	dB
Ground Absorption (A_g)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	dB
Barrier Correction (A_{bar})	-4.9	-4.9	-5.1	-5.4	-6.0	-6.9	-8.3	—	dB
Resultant Noise Levels (L_p)	43.7	38.7	28.5	20.2	19.6	15.7	12.3	27.5	dB

L_w - Sound Power Levels, L_w : BS EN ISO 13487:2003. Reference 1×10^{-12} watts. L_p - Sound Pressure Levels. Reference $2 \times 10^{-5} \text{ Nm}^{-2}$

4.4.2 Source 2 – (Gunter Evaporator)

Gunter Evaporator	Octave Band Centre Frequency (Hz)							Sum (A)	Units
	63	125	250	500	1000	2000	4000		
Sound Power Levels (L_w)	83.0	78.0	68.0	60.0	50.0	58.0	55.0	67.5	dB
Directivity (D_e)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	dB
Geometric Divergence (A_{div})	-28.2	-28.2	-28.2	-28.2	-28.2	-28.2	-28.2	—	dB
Atmospheric Absorption (A_{atm})	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	dB
Ground Absorption (A_g)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	dB
Barrier Correction (A_{bar})	-5.0	-6.2	-7.3	-8.9	-10.9	-13.4	-16.1	—	dB
Resultant Noise Levels (L_p)	49.2	43.6	32.5	22.9	20.0	16.4	10.7	31.1	dB

L_w - Sound Power Levels, L_w : BS EN ISO 13487:2003. Reference 1×10^{-12} watts. L_p - Sound Pressure Levels. Reference $2 \times 10^{-5} \text{ Nm}^{-2}$

5 ASSESSMENTS

5.1 Day Time (16 hour - 07:00 to 23:00)

Source	Operating Times	Source Position	
Gunter Evaporator	24 hours per day	within dedicated plant area	
Gunter Evaporator	24 hours per day	within dedicated plant area	
Assessment Position	Residential property adjacent to the site		
Background Position	Lamp post on Lincoln Ave		
Distance	Min 7.3 from the edge of the source to the assessment position		
Item	Calculation	Clause	Commentary
Specific Noise Level Leq, 1 hour	33 dB	6.3	Specific noise level was calculated from measurements made at 1m ISO 9613:1996
Acoustic Feature Correction	+ 0 dB	8.2.	Reference section 8.2 of BS4142:1997
Rating Level	33 dB	8.3.	The acoustic feature correction is added to the specific noise level to obtain the rating level
Background Noise Level	48 dB	7.1.	The background noise level was measured at an equivalent position and corrected for position.
Assessment Level	-15 dB	9.	The background level is subtracted from the rating level. (Numerical values)
Conclusion BS 4142:1997 ₃₁	Complaints Likely – Assessment of around +10 dB Complaints Marginal – Assessment of around +5 dB Complaints Unlikely – Assessment of around -10 dB or less		
Assessment	-15 dB		
Conclusion	The assessment level is below 'Complaints Unlikely'		
Test Laboratory:	4193		
Report Reference:	KR03715 / 01		
Test Date:	17/03/2014 - 18/03/2014		
Approval Date:	14/05/2014		

5.2 Night Time (8 hour – 23:00 to 07:00)

Source	Operating Times	Source Position	
Gunter Evaporator	24 hours per day	within dedicated plant area	
Gunter Evaporator	24 hours per day	within dedicated plant area	
Assessment Position	Residential property adjacent to the site		
Background Position	Lamp post on Lincoln Ave		
Distance	Min 7.3 from the edge of the source to the assessment position		
Item	Calculation	Clause	Commentary
Specific Noise Level Logarithmic	33 dB	6.3	Specific noise level was calculated from measurements made at 1m ISO 9513:1996m.
Acoustic Feature Correction	+0 dB	8.2	Reference section 8.2 of BS4142:1997.
Rating Level	33 dB	8.3	The acoustic feature correction is added to the specific noise level to obtain the rating level.
Background Noise Level	38 dB	7.1	The background noise level was measured at an equivalent position.
Assessment Level	-5 dB	9	The background level is subtracted from the rating level. (Numerical values)
Conclusion BS 4142:1997 ₁₀	Complaint Likely – Assessment of around +10 dB Complaints Marginal – Assessment of around +5 dB Complaints Unlikely – Assessment of around -10 dB or less		
Assessment	-5 dB		
Conclusion	The assessment level is below 'Complaints Marginal'		
Test Laboratory:	4193		
Report Reference:	KR03715 / 02		
Test Date:	17/03/2014 - 18/03/2014		
Approval Date:	14/05/2014		



6 CONCLUSIONS

6.1 BS 4142:1997

The British Standard 4142:1997 assessments, which are covered by the KR Associates (UK) Ltd scope of accreditation from the United Kingdom Accreditation Service ("UKAS"), indicates that the proposed plant will be unlikely to give rise to complaints for local residents.

7 APPENDIX A - BS 4142:1997 INFORMATION TO BE REPORTED

7.1 A) Source under Investigation

	Description of Source	Type	Manufacturer	Model
1)	Gunter Evaporator	Evaporator	Gunter	GDF020.1C/27-FL150.E
	Gunter Evaporator	Evaporator	Gunter	S-GDF020.1C/27-AN150.E
2)	Description of Source	Source Location	Hours of Operation	Mode of Operation
3)	Gunter Evaporator	within dedicated plant area	24 hours per day	Continuously On Demand
4)	Gunter Evaporator	within dedicated plant area	24 hours per day	Continuously On Demand
	Description of Premises	Existing Co-op store located adjacent to residential properties with a residential flat over the store		

7.2 B) Subjective Impression of Source at Assessment Position

	Dominance	The sources will not be the dominant noise source at the assessment position
1)	Audibility	The sources will not be audible at the assessment position
2)	Residual Noise Sources	Primarily road traffic noise

7.3 C) Relative Positions

		Residential premises adjacent to the store		
1)	Assessment Position	BS 4142:1997 Criteria	Details	Compliance with Criteria
		Section 5	1.0m from facade (external)	Assessment position is valid
2)	Source Measurement	The source sound power levels were supplied by the client. It is believed the sound power levels were established in accordance with BS EN 15487:2003		
	Justification	The site has yet to be developed or the source installed.		
3)	Background Measurement	Measured within Lamp post on Lincoln Ave (Equivalent Position)		
	Justification	BS 4142:1997 Criteria	Details	Compliance with Criteria
		Section 5.3	3.5m to any reflecting surface	Does comply with Criteria
		Section 5.3 - Note 1	Height 1.2m to 1.5m	Does comply with Criteria
		Section 5.3 - Note 2	1 st floor 1m to facade	Does comply with Criteria
		Section 5.3 - Note 3	Measurement Height	Does comply with Criteria
			Distance to Reflecting Surface	Does comply with Criteria
		In order to record remote background levels the noise meter had to be left in a secure position. The position represented the assessment position with the constraints of the site.		
4)	Topography, surfaces etc.	The ground is hard and flat. However there is no ground reflection due to the barrier affected by the edge of the chiller housing.		
5)	Relative Distances	The plant is located approximately 7.3 - 5,683,696.8 from the proposed assessment position.		

7.4 D) Noise Measurement Equipment Calibration

1)	Type	Sound Level Meter	Microphone	Calibrator
		NL - 32	UC - 53A	NC - 74
2)	Manufacturer	Rion	Rion	Rion
3)	Serial Number	00503252	32866	34304655
4)	Certificate Number	Certificate: 06680	Certificate: 06680	Certificate: 06672
	Verification Date	15/08/2012	15/08/2012	10/08/2012

7.5 E) Noise Measurement Equipment Operation Test

1)	Ref. Level of Calibrator	94 dB@1000Hz
2)	Meter Reading Before	94 dB - Meter operation checked. Meter in good working order
	Meter Reading After	94 dB - Meter operation checked. Meter in good working order.

7.6 F) Weather Conditions

1)	Wind Speed	0.1 ms-1 to 8.7 ms-1
	Wind Direction	Variable
2)	Temperature inversion	unlikely to have occurred during the measurement period
3)	Precipitation	Not within the measurement period - See Appendix C
4)	Fog	No fog within the measurement period

7.7 G) Date and Time of Measurements

1)	Source Measurements	Not Known
	Background Measurements	17/03/2014

7.8 H) Specific Noise Levels

1)	Residual Noise Level	Day Time	Night Time
		{07:00 - 23:00}	{23:00 to 07:00}
2)	Residual Noise Level	Manufacturers Data Supplied	Manufacturers Data Supplied
	Method of Determination	Not required	Not required
3)	Specific Noise Level	Leq, 1 hour 33 dB	Leq, 5 minutes 33 dB
	Method of Determination	Calculated using the supplied manufacturers sound power levels	
4)	Justification	The source has yet to be installed so the manufacturers data was used	
5)	Correction Applied	Not Applicable	Not Applicable

7.9 I) Measurement Time Interval

1)	Source Measurements	$T_m = 5$ minutes	
	Background Measurements	Day Time	Night Time
		{07:00 – 23:00}	{23:00 to 07:00}
		$T_m = 16$ hours	$T_m = 8$ hours

7.10 J) Reference Time Interval

1)	Reference Time Interval	Day Time	Night Time
		{07:00 – 23:00}	{23:00 to 07:00}
		$T_r = 1$ hour	$T_r = 5$ minutes

7.11 K) Rating Levels

1)	Specific Noise Level	Day Time	Night Time
		{07:00 – 23:00}	{23:00 to 07:00}
		$L_{Aeq,1hour} = 40$ dB	$L_{Aeq,2hour} = 26$ dB
2)	Acoustic feature correction	+0 dB	+0 dB
	Justification	it was not appropriate to add the character correction to the specific noise level	
3)	Rating Level	$L_{Aeq,1hour} = 33$ dB	$L_{Aeq,2hour} = 33$ dB

7.12 L) Background Noise Levels

1)	Background Noise Levels	Day Time	Night Time
		{07:00 – 23:00}	{23:00 to 07:00}
		$L_{Aeq,1hour} = 48$ dB	$L_{Aeq,2hour} = 38$ dB
	Assessment Position	Residential Property adjacent to site	
Justification		Not taken at rear due to existing and operating plant. Noise map correction for background levels	

7.13 M) Excess of Rating over Background Level

1)	Assessment	Day Time	Night Time
		{07:00 – 23:00}	{23:00 to 07:00}
		-15 dB	-5 dB
2)	Conclusion	below 'Complaints Unlikely'	below 'Complaints Marginal'

1 APPENDIX B – SITE LAYOUT / PHOTOGRAPHS

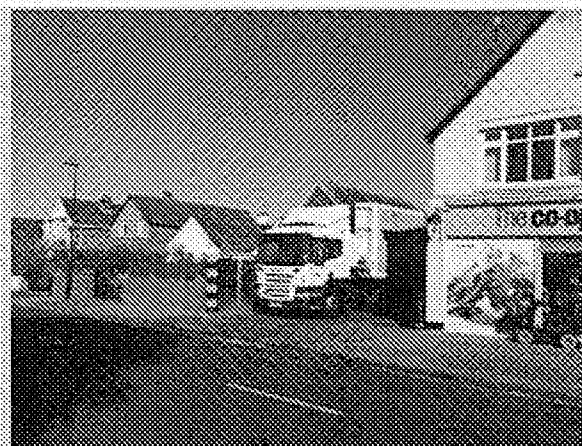
1.1 Site Location



Proposed Source Location: Latitude: 50.795667° Longitude: -0.719335° Elevation: 0.0m



Front of site



Delivery to site

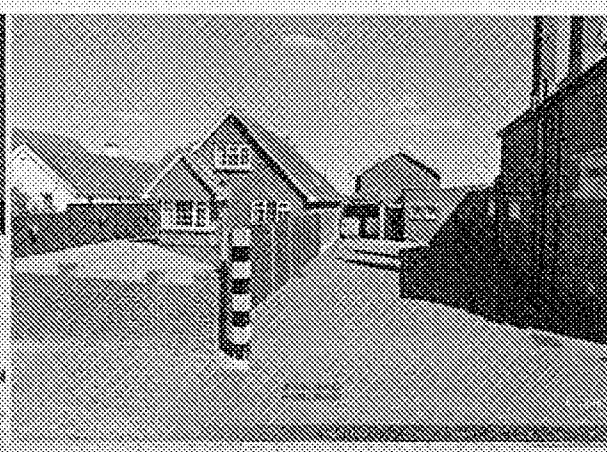
1.2 Assessment Position



Assessment position 1:	Latitude: 50.785638°	Longitude: -0.719923°	Elevation: 5.0m
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Front of Store



Front of residential property

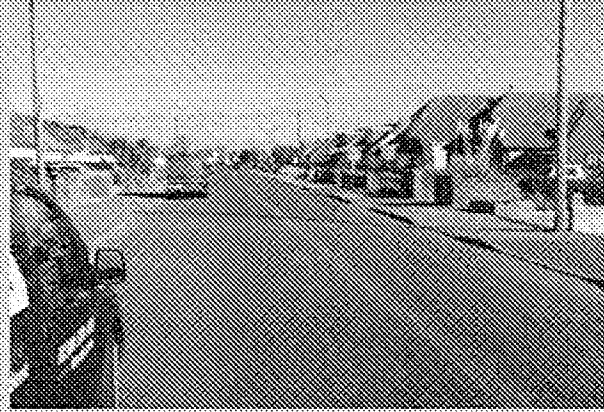
1.3 Background Measurement Position



Background Measurement:	Latitude:	50.786724°	Longitude:	-0.718818°	Elevation:	4m
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Lamp post on Lincoln Avenue

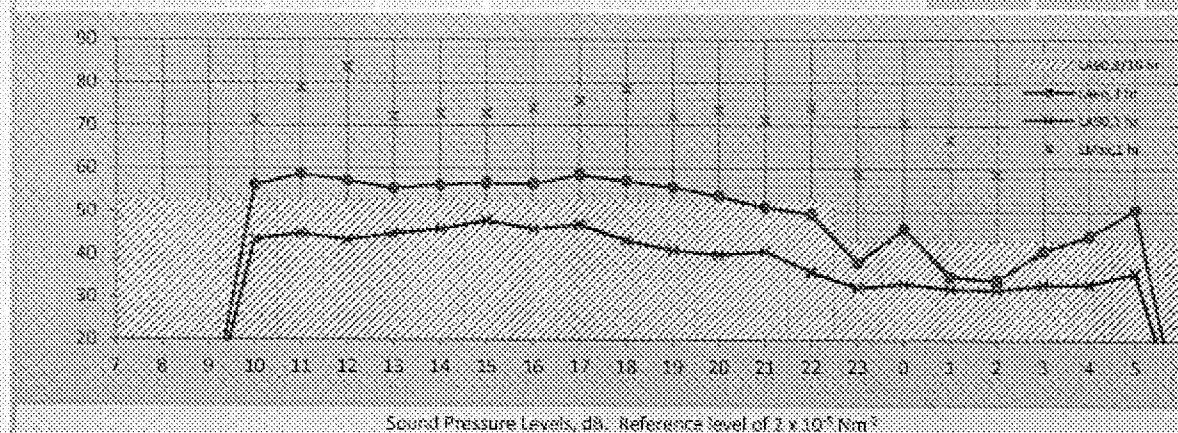


Lincoln Avenue

2 APPENDIX C - BACKGROUND NOISE LEVELS

2.1 10:00 Monday 17th March 2014 to 07:00 Tuesday 18th March 2014

Time Period	Date	Minimum 5 minute			1 Hour			Day and Night		
		Leq, 5 min	L ₁₀ , 5 min	L ₅₀ , 5 min	L ₁₀ , 1 hour	L ₅₀ , 1 hour	L ₉₀ , 1 hour	L ₁₀ , 1	L ₅₀ , 1	L ₉₀ , 1 hour
07:00 – 08:00	---	---	---	---	---	---	---	57.8	53.0	52.6
08:00 – 09:00	---	---	---	---	---	---	---			
09:00 – 10:00	---	---	---	---	---	---	---			
10:00 – 11:00	71.4	50.0	51.7	39.2	56.1	57.1	43.5			
11:00 – 12:00	78.8	51.7	52.1	40.6	58.7	59.9	44.9			
12:00 – 13:00	81.7	52.5	54.1	41.6	57.1	58.6	43.3			
13:00 – 14:00	72.2	47.6	50.9	41.2	55.4	56.7	48.5			
14:00 – 15:00	72.8	54.3	55.3	42.2	56.2	57.7	45.9			
15:00 – 16:00	72.9	52.1	51.0	42.9	56.6	58.1	47.9			
16:00 – 17:00	74.2	51.1	52.3	44.2	56.5	57.7	46.0			
17:00 – 18:00	75.3	55.7	56.5	44.0	58.5	60.5	46.9			
18:00 – 19:00	78.5	51.7	51.4	38.9	57.1	58.8	43.3			
19:00 – 20:00	72.0	51.3	50.6	40.6	55.5	56.6	41.0	52.0	49.9	49.2
20:00 – 21:00	73.5	48.0	47.0	35.2	53.6	52.7	39.9			
21:00 – 22:00	71.3	45.6	46.5	38.7	51.0	48.7	40.0			
22:00 – 23:00	74.3	38.4	37.5	33.7	49.5	46.9	36.0			
23:00 – 00:00	58.8	31.7	37.8	34.6	38.1	38.6	32.3			
00:00 – 01:00	70.7	31.0	34.2	31.0	46.1	39.0	33.3			
01:00 – 02:00	68.7	30.0	31.4	30.5	34.8	35.6	32.0			
02:00 – 03:00	58.7	30.1	31.8	30.6	34.1	35.8	31.8			
03:00 – 04:00	72.1	30.0	31.5	30.6	40.8	35.7	32.5			
04:00 – 05:00	77.5	30.7	33.3	30.7	44.4	37.2	33.0			
05:00 – 06:00	71.4	38.4	37.3	32.8	50.5	51.0	35.8			
06:00 – 07:00										



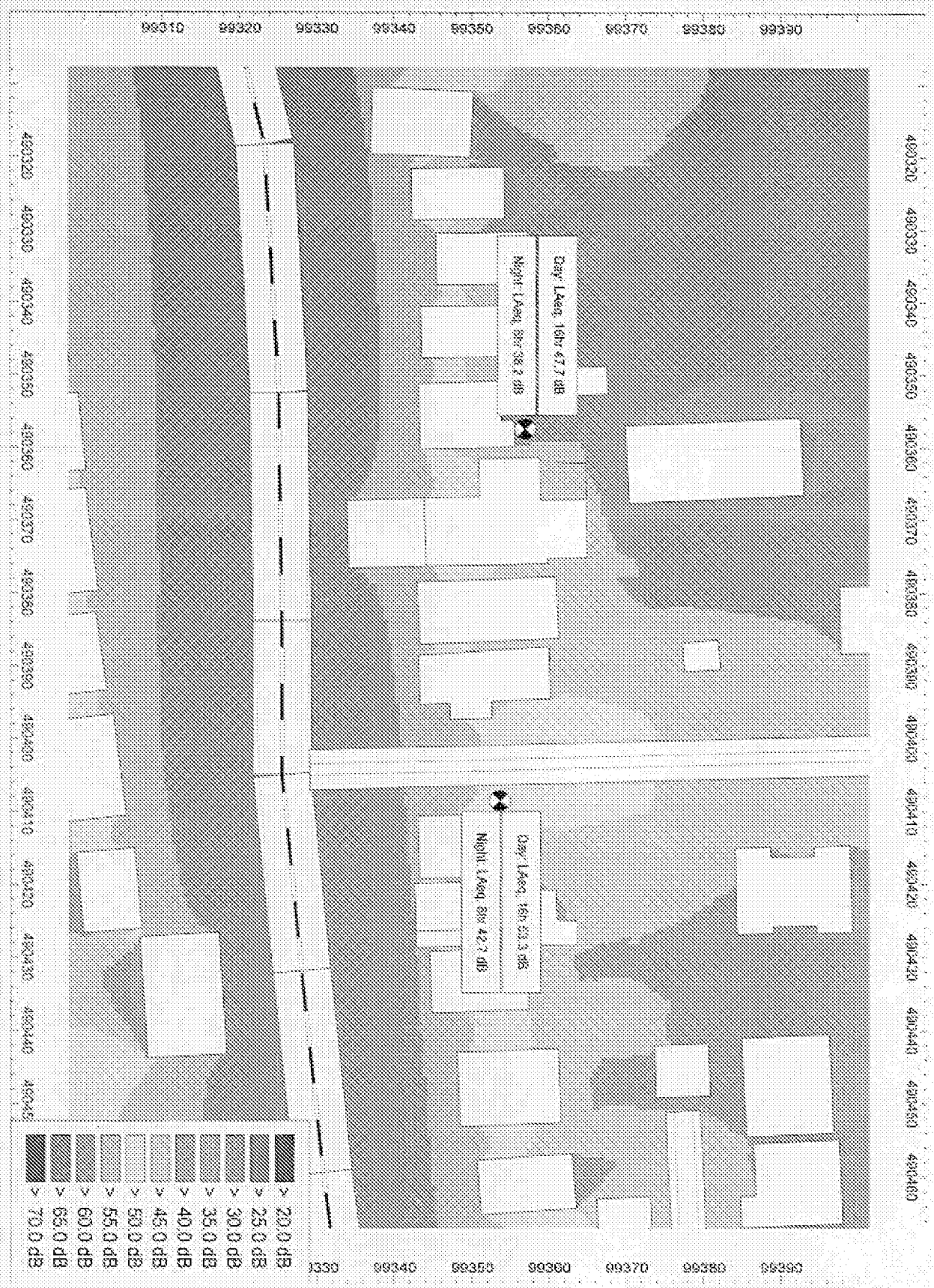


2.2 Minimum Levels Table

Time	Leq	Minimum 5 minute		Minimum 1 hour		Minimum Day and Night	
		Leq5	Leq5	Leq1	Leq1	LeqD	LeqN
07:00 – 23:00	83.7	38.4	33.7	49.5	36.0	57.8	52.5
23:00 – 07:00	77.5	30.0	30.5	34.1	31.8	52.0	43.2
	dB, t = 1 hour	dB, t = 5 minutes		dB, t = 1 hour		dB, t = 15 and 8 hours	
Sound Pressure Levels, dB. Reference level of $2 \times 10^{-5} \text{ Nm}^{-2}$							

2.3 Weather Data

Date	Time	Temperature			Atmosphere			Wind	
		Temp	Dew	RH%	QNH	Vis	Rain	Direction	Speed
17 th March 2014	00:00	7.0	4.0	66%	1017	10.0	--	West	5.7
	03:00	8.0	5.0	62%	1016	10.0	--	South	5.1
	06:00	12.0	5.0	62%	1016	10.0	--	SW	6.7
	09:00	11.0	5.0	67%	1016	10.0	--	SW	7.7
	12:00	11.0	6.0	64%	1017	10.0	--	West	7.1
	15:00	10.0	4.0	67%	1018	10.0	--	West	8.7
	18:00	9.0	3.0	82%	1019	10.0	--	West	5.1
	21:00	8.0	4.0	67%	1020	10.0	--	West	4.1
	15:00	7.0	4.0	66%	1017	10.0	--	West	5.7
	18:00	8.0	5.0	62%	1016	10.0	--	South	5.1
	21:00	12.0	5.0	62%	1016	10.0	--	SW	6.7
3 hour time period		°C	°C	% RH	mBar	km	--	Degrees	ms ⁻¹



3.1 Background Levels Normalisation Map

3 APPENDIX D - NOISE MAP



3.2 Plant Noise Impact Map



4 APPENDIX E – SOUND POWER LEVELS

4.1 Day Time (07:00 – 23:00)

4.1.1 Gunter Evaporator

Heat Exchangers – Forced Convection Air Cooled Refrigerant

Condensers and Dry Coolers – Sound Measurements

British Standard 13487: 2003 (Engineering Grade – BS EN ISO 3744:2010)

Manufacturer	Model	Conditions
Gunter	GDF020.1C/27 xL150 E	Not provided by Manufacturer

Location of Tests: Not provided by Manufacturer

Date of Tests: Not Known

Background Noise Correction, K_1 : Not provided by Manufacturer

Environmental Correction, K_2 : Not provided by Manufacturer

Frequency (Hz)

L_w

50 77

63 79

80 73

100 72

125 71

160 68

200 62

250 57

315 56

400 54

500 50

630 50

800 53

1000 54

1250 51

1600 50

2000 51

2500 49

3150 48

4000 47

5000 45

Octave Band Centre Frequency (Hz)

3150	48	63	125	250	500	1000	2000	4000
4000	47	78	73	63	55	55	53	50

Sound Power Level, L_w , Reference 1×10^{-12} watts

$L_w(A)$

63 dB

Sound power level (Engineering Grade), Reference 1×10^{-12} watts

Test Laboratory: 4183 - Tests not covered by KR Associates (UK) Ltd scope of accreditation

Report Reference: KR03715 / 03

Test Date: 14th May 2012

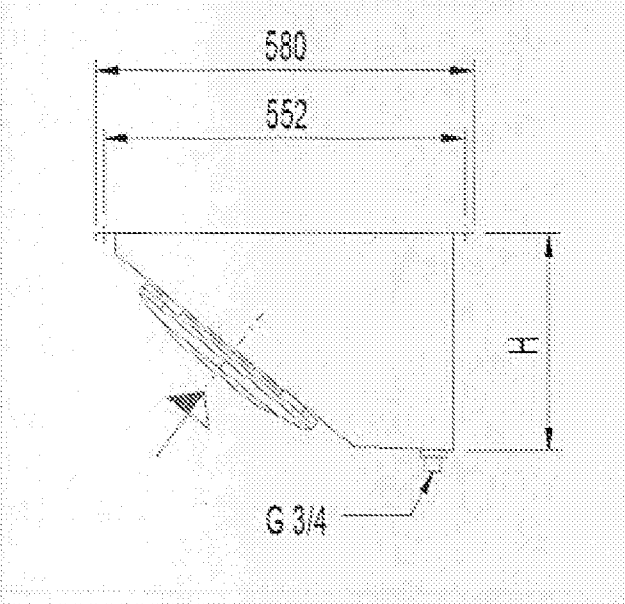
Approval Date: 20th May 2012

Heat Exchangers – Forced Convection Air Cooled Refrigerant

Condensers and Dry Coolers – Sound Measurements

British Standard 13487: 2003 (Engineering Grade – BS EN ISO 3744:2010)



Manufacturer		Model		Conditions				
Gunter		S-GDHD20.1C/27-AN150LE		Not provided by Manufacturer				
Location of Tests		Not provided by Manufacturer						
Date of Tests		Not known						
Background Noise Correction, K _b		Not provided by Manufacturer						
Environmental Correction, K _e		Not provided by Manufacturer						
Frequency (Hz)	L _{wp}							
50	82							
63	84							
80	78							
100	77							
125	76							
160	73							
200	67							
250	62							
315	61							
400	59							
500	55							
630	53							
800	58							
1000	59							
1250	56							
1600	55							
2000	55							
2500	54							
3150	53							
4000	52							
5000	50							
		Octave Band Centre Frequency (Hz)						
		63	125	250	500	1000	2000	4000
		83	78	68	60	60	58	55
		Sound Power Level, L _{wp} Reference 1 x 10 ⁻¹² watts						
L _{w(A)}		68 dB		Sound power level (Engineering Grade). Reference 1 x 10 ⁻¹² watts				
Test Laboratory:		4353 – Tests not covered by KR Associates (UK) Ltd scope of accreditation						
Report Reference:		KR03715 / 04						
Test Date:		14th May 2012						
Approval Date:		20th May 2012						

4.2 Night Time (23:00 – 07:00)

4.2.1 Gunter Evaporator

Heat Exchangers – Forced Convection Air Cooled Refrigerant

Condensers and Dry Coolers – Sound Measurements

British Standard 13487: 2003 (Engineering Grade – BS EN ISO 3744:2010)

Manufacturer

Model

Conditions

Gunter

GD1020.1C/27-EL150-E

Not provided by Manufacturer

Location of Tests

Not provided by Manufacturer

Date of Tests

14th May 2012

Background Noise Correction, K_1

Not provided by Manufacturer

Environmental Correction, K_2

Not provided by Manufacturer

Frequency (Hz)

L_w

50

77

63

78

80

73

100

72

125

71

160

68

200

62

250

57

315

56

400

54

500

50

630

50

800

53

1000

54

1250

51

1600

50

2000

51

2500

49

Octave Band Centre Frequency (Hz)

3150

48

63

125

250

500

1000

2000

4000

4000

47

78

73

63

62

55

53

50

5000

45

Sound Power Level, L_w Reference 1×10^{-12} watts

$L_w(A)$

63 dB

Sound power level (Engineering Grade). Reference 1×10^{-12} watts

Test Laboratory:

4193 - Tests not covered by KR Associates (UK) Ltd scope of accreditation

Report Reference:

KR03715 / 07

Test Date:

14th May 2012

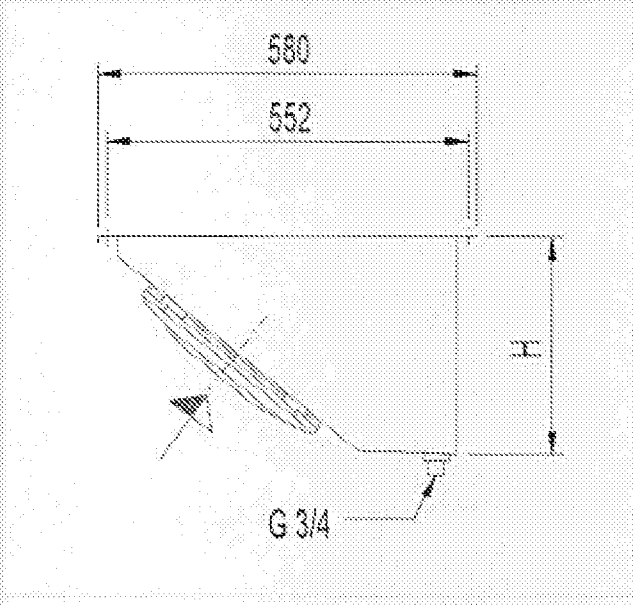
Approval Date:

20th May 2012

Heat Exchangers – Forced Convection Air Cooled Refrigerant Condensers and Dry Coolers – Sound Measurements

British Standard 13487: 2003 (Engineering Grade – BS EN ISO 3744:2010)



Manufacturer		Model		Comments				
Gunter		S-GD020.1C/27-AN150.E		Not provided by Manufacturer				
Location of Tests		Not provided by Manufacturer						
Date of Tests		14th May 2012						
Background Noise Correction, K ₁		Not provided by Manufacturer						
Environmental Correction, K ₂		Not provided by Manufacturer						
Frequency (Hz)	K ₃							
50	83							
63	84							
80	78							
100	77							
125	76							
160	73							
200	67							
250	62							
315	58							
400	58							
500	55							
630	55							
800	58							
1000	59							
1250	56							
1600	55							
2000	56							
2500	54							
		Octave Band Centre Frequency (Hz)						
3150	53	63	125	250	500	1000	2000	4000
4000	52	83	78	68	60	60	58	55
5000	50	Sound Power Level, L _p – Reference 1 x 10 ⁻¹² watts						
L _w (A)		68 dB		Sound power level (Engineering Grade), Reference 1 x 10 ⁻¹² watts				
Test Laboratory:		4753 – Tests not covered by KR Associates (UK) Ltd scope of accreditation						
Report Reference:		KRD3715 / 08						
Test Date:		14th May 2012						
Approval Date:		20th May 2012						

5 APPENDIX F – ADDITIONAL ASSESSMENTS (OUTSIDE UKAS SCOPE OF ACCREDITATION)

5.1 Guidelines for Community Noise (World Health Organisation)

5.1.1 Criteria

At the beginning of the document published by the World Health Organisation ("WHO") entitled "Criteria for Community Noise" there is the following statement.

"This document is not a formal publication of the World Health Organisation and all rights are reserved by the Organisation. This document may, however, be freely reviewed, abstracted, reproduced or translated in part, but not for sale or for use in conjunction with commercial purposes."

Specific Environment	Critical health effect(s)	Level dB	Time Base (Hours)	Level dB
Outside Bedrooms	Sleep disturbance, window open (Outdoor Values)	45	8	60
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	15	—
Inside Bedrooms	Sleep disturbance, night time	30	8	45

5.1.2 Assessment – Day Time 07:00 to 23:00

World Health Organisation

Guidelines for Community Noise

Published in 1999 by Birgitta Berglund, Thomas Lindvall and Kee-Tai Goh



Quietly confident

Source	Operating Times		Source Position
Gunter Evaporator	24 hours per day		within dedicated plant area
Gunter Evaporator	24 hours per day		within dedicated plant area
DD	0		0
Gunter Evaporator	24 hours per day		0
Assessment Position	Residential Property above site		
Item	L _{eq} hours		Commentary
Sound Pressure Level 1m from residential facade	33 dB(A)		External 1m from the residential facade
Sleep disturbance windows open (Outdoor Values)	45 dB (A)	—	Absolute Criteria for serious annoyance.
Dwellings, indoors	—	50 dB	Absolute External Criteria
Compliance with Criteria	Yes	Yes	The calculated levels fall below the absolute criteria levels.

5.1.3 Assessment – Night Time 23:00 to 07:00

World Health Organisation Guidelines for Community Noise

Published in 1999 by Birgitta Berglund, Thomas Lindvall and Kee-Tai Goh



Source	Operating Times		Source Position
Gunter Evaporator	24 hours per day		within dedicated plant area
Gunter Evaporator	24 hours per day		within dedicated plant area
SS	0		0
Gunter Evaporator	24 hours per day		0
Assessment Position	Residential Property above site		
Item	Legislation	Limitation	Commentary
Sound Pressure Level 1m from residential facade	13 dB	40 dB	External 1m from the residential facade
Sleep disturbance windows open (Outdoor Values)	45 dB	50 dB	Absolute External Criteria
Compliance with Criteria	Yes	Yes	The calculated levels fall below the absolute criteria levels.

5.2 Night Noise Guidelines (World Health Organisation - Europe)

5.2.1 Criteria

The work of the original WHO document detailed above was extended by a joint report published in 2009 by the World Health Organisation and the European Union.

"The goal of the NNGL project was to provide and expand scientific advice to the European Commission and its Member States in developing future legislation in the area of night noise exposure, control and surveillance. The key objective of the project was to reach a consensus of experts and key stakeholders on the following subjects:

a) Guideline values for night noise to protect the public from adverse health effects...."

Section 7 of the final implementation report details the levels for which there are no observed effects:

"...the observed effects thresholds are provided: the level above which an effect starts to occur or shows itself to be dependent on the exposure level."

Effect of noise	Description	Indicator	Threshold , dB
Biological Effects	EEG awakening	$L_{Aeq,noise}$	35
	Motility, onset of motility	$L_{Aeq,noise}$	32
	Changes in duration of various stages of sleep, in sleep structure and fragmentation of sleep	$L_{Aeq,noise}$	35
Sleep Quality	Waking up in the night and/or too early in the morning	$L_{Aeq,noise}$	42
	Increased average motility when sleeping	$L_{Aeq,noise}$	42
Well-being	Self-reported sleep disturbance	$L_{Aeq,noise}$	42
	Use of somnifacient drugs	$L_{Aeq,noise}$	40
Medical Conditions	Environmental insomnia	$L_{Aeq,noise}$	42

5.2.2 Assessment – Night time 23:00 to 07:00

World Health Organisation Europe

Night Noise Guidelines

Published in 2009 – ISBN 978 92 890 4173 7



Source	Operating Times		Source Position
Gunter Evaporator	24 hours per day		within dedicated plant area
Gunter Evaporator	24 hours per day		within dedicated plant area
DB	0		0
Gunter Evaporator	24 hours per day		0
Assessment Position	Residential Property above site		
Item	Large source	Small source	Commentary
Sound Pressure Level 1m from residential facade	33 dB	40 dB	External 1m from the residential facade
Well Being (Lowest)	40 dB	—	Absolute Criteria. Use of somnifacient drugs
Biological Effects (Lowest)	—	47	Absolute Criteria. Motility onset of Motility
Biological Effects (Lowest)	Yes	Yes	The calculated levels fall below the absolute criteria levels.



6 REFERENCES

6.1 British Standard 4142: 1997

Rating industrial noise affecting mixed residential and industrial areas.

6.2 British Standard 13487: 2003

Heat Exchangers – Forced air convection air cooled refrigerant condensers and dry coolers – Sound measurement.

6.3 International Standard Organisation 9613 – Part 1: 1993

Acoustics – Attenuation of sound propagation outdoors.

Part 1 - Part 1: Calculation of the absorption of sound by the atmosphere.

6.4 International Standard Organisation 9613 – Part 2: 1996

Acoustics – Attenuation of sound during propagation outdoors.

6.5 World Health Organisation Guidelines for Community noise: 1999

Published by Birgitta Berglund, Thomas Lindvall, Dietrich Schwela and Kee-Tai Goh.

6.6 World Health Organisation Europe Night Noise Guidelines 2009

-end-

