



4193

Rating of Industrial Noise affecting Mixed Industrial and Residential Areas

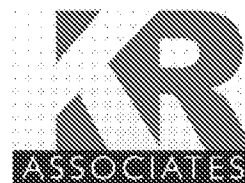
British Standard 4142:1997

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.



KR Associates (UK) Ltd

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Consultant: Mr. R. M. Scrivener



4193

Accredited to
ISO/IEC 17025:2005

Schedule of Accreditation

Issued by

United Kingdom Accreditation Service

21 – 47 High Street, Feltham, Middlesex, TW13 4UN.

KR Associates (UK) Ltd

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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, floors & 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

Version Number	Version Date	Details	Author
KR03715 v1.0 (Full)	20 th March 2014	Initial Issue of Report	Mr. R. M. Scrivener
KR03715 v1.1 (Full)	2 nd April 2014	Amendment to plant	Miss. E. Samphier

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.


2nd April 2014

Mr. R. M. Scrivener, MSc, MIOA



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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 in West Sussex to support the planning application for the proposed 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	LAeq,1 hours 33 dB	LAeq,5 minutes 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	LA90,16 hours 53 dB	LA90,8 hours 43 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	-20	-10
Likelihood of Complaints	below 'Complaints Unlikely'	below 'Complaints Unlikely'

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 number Gunter Evaporator 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, though the rating levels at night are below the criteria defined in note 1 of section 1.

2.3 Specific Noise Levels

2.3.1 Assessment Position

The assessment position was established as the residential property above site located approximately 17.9m from the proposed refrigeration and air conditioning sources within the dedicated plant area.

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 above 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.

2.4.2 Equivalent Position

The background noise levels were measured at the equivalent position located on a lamp post on Lincoln Avenue between 17th March 2014 and 18th March 2014.

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 Note	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	L _{Aeq,1 hour} 50 dB	L _{Aeq,5 minutes} 34 dB
Maximum Specific Noise Levels	L _{Aeq,1 hour} 30 dB	L _{Aeq,5 minutes} 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 Governments 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 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	89.0	85.0	74.0	67.0	69.0	67.0	62.0	75.1	dB
Gunter Evaporator	89.0	85.0	74.0	67.0	69.0	67.0	62.0	75.1	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	89.0	85.0	74.0	67.0	69.0	67.0	62.0	75.1	dB
Gunter Evaporator	89.0	85.0	74.0	67.0	69.0	67.0	62.0	75.1	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
$A_{bar} = 10 \cdot \log_{10} [3 + (40 \cdot \delta / \lambda) - A_{gr}]$ *Note1 where $\delta = a + b - r$ and $\lambda = c / f$	A_{bar} = Effective barrier attenuation (dB) A_{gr} = 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)	89.0	85.0	74.0	67.0	69.0	67.0	62.0	75.1	dB
Directivity (D_c)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	dB
Geometric Divergence (A_{div})	-36.1	-36.1	-36.1	-36.1	-36.1	-36.1	-36.1	--	dB
Atmospheric Absorption (A_{atm})	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	dB
Ground Absorption (A_{gr})	3.0	3.0	3.0	3.0	3.0	3.0	3.0	--	dB
Barrier Correction (A_{bar})	-6.9	-8.4	-10.3	-12.7	-15.3	-18.1	-21.0	--	dB
Resultant Noise Levels (L_p)	49.0	43.6	30.6	21.3	20.6	15.8	7.9	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 $2 \times 10^{-5} \text{ Nm}^{-2}$

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)	89.0	85.0	74.0	67.0	69.0	67.0	62.0	75.1	dB
Directivity (D_c)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	dB
Geometric Divergence (A_{div})	-36.6	-36.6	-36.6	-36.6	-36.6	-36.6	-36.6	--	dB
Atmospheric Absorption (A_{atm})	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	dB
Ground Absorption (A_{gr})	3.0	3.0	3.0	3.0	3.0	3.0	3.0	--	dB
Barrier Correction (A_{bar})	-7.0	-8.4	-10.4	-12.7	-15.4	-18.2	-21.1	--	dB
Resultant Noise Levels (L_p)	48.4	43.0	30.0	20.6	20.0	15.2	7.3	30	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 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)	89.0	85.0	74.0	67.0	69.0	67.0	62.0	75.1	dB
Directivity (D_c)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	dB
Geometric Divergence (A_{div})	-36.1	-36.1	-36.1	-36.1	-36.1	-36.1	-36.1	--	dB
Atmospheric Absorption (A_{atm})	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	dB
Ground Absorption (A_{gr})	3.0	3.0	3.0	3.0	3.0	3.0	3.0	--	dB
Barrier Correction (A_{bar})	-6.9	-8.4	-10.3	-12.7	-15.3	-18.1	-21.0	--	dB
Resultant Noise Levels (L_p)	49.0	43.6	30.6	21.3	20.6	15.8	7.9	30.6	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)	89.0	85.0	74.0	67.0	69.0	67.0	62.0	75.1	dB
Directivity (D_c)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	dB
Geometric Divergence (A_{div})	-36.6	-36.6	-36.6	-36.6	-36.6	-36.6	-36.6	--	dB
Atmospheric Absorption (A_{atm})	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	dB
Ground Absorption (A_{gr})	3.0	3.0	3.0	3.0	3.0	3.0	3.0	--	dB
Barrier Correction (A_{bar})	-7.0	-8.4	-10.4	-12.7	-15.4	-18.2	-21.1	--	dB
Resultant Noise Levels (L_p)	48.4	43.0	30.0	20.6	20.0	15.2	7.3	30.0	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)

 Rating Industrial Noise affecting Mixed Industrial and Residential Areas British Standard 4142:1997 Day Time (07:00 to 23:00) 			
Source	Operating Times		Source Position
Gunter Evaporator	24 hours per day		Located within dedicated plant area
Gunter Evaporator			
Assessment Position	Residential Property above site		
Background Position	Lamp post on Lincoln Ave		
Distance	17.9m from the edge of the source to the assessment position.		
Item	Calculation	Clause	Commentary
Specific Noise Level L_{Aeq,1hour}	33 dB	6.3	Specific noise level was calculated from measurements made at 1m ISO 9613:1996 ⁽¹⁾ .
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	53 dB	7.1.	The background noise level was measured at an equivalent position.
Assessment Level	-20 dB	9	The background level is subtracted from the rating level. (Numerical values)
Conclusion BS 4142:1997⁽¹⁾	Complaint Likely – Assessment of around +10 dB Complaints Marginal – Assessment of around +5 dB Complaints Unlikely – Assessment of around -10 dB or less		
Assessment	-20 dB		
Conclusion	The assessment level is below 'Complaints Unlikely'		
Test Laboratory:	4193		
Report Reference:	KR03715 / 01		
Test Date:	17 th March 2014 to 18 th March 2014		
Approval Date:	2 nd April 2014		

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



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Rating Industrial Noise affecting Mixed Industrial and Residential Areas

British Standard 4142:1997 Night Time (23:00 to 07:00)



Source	Operating Times		Source Position
Gunter Evaporator	24 hours per day		Located within dedicated plant area
Gunter Evaporator			
Assessment Position	Residential Property above site		
Background Position	Lamp post on Lincoln Ave		
Distance	17.9m from the edge of the source to the assessment position.		
Item	Calculation	Clause	Commentary
Specific Noise Level <i>L_{Aeq,5 minutes}</i>	33 dB	6.3	Specific noise level was calculated from measurements made at 1m ISO 9613:1996 ^[1] .
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	43 dB	7.1.	The background noise level was measured at an equivalent position.
Assessment Level	-10 dB	9	The background level is subtracted from the rating level. (Numerical values)
Conclusion BS 4142:1997 ^[1]	Complaint Likely – Assessment of around +10 dB Complaints Marginal – Assessment of around +5 dB Complaints Unlikely – Assessment of around -10 dB or less		
Assessment	-10 dB		
Conclusion	The assessment level is below 'Complaints Unlikely'		
Test Laboratory:	4193		
Report Reference:	KR03715 / 02		
Test Date:	17 th March 2014 to 18 th March 2014		
Approval Date:	2 nd April 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. It should be noted that the night time assessment falls outside the scope of British Standard 4124:1997 as defined in section 1 – note 1.

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	S-GDF020.1C/27-AN150.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	Current co-op with residential property above. Quiet residential area.		

7.2 B) Subjective Impression of Source at Assessment Position

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

7.3 C) Relative Positions

		Residential Property above site		
1)	Assessment Position	BS 4142:1997 Criteria	Details	Compliance with Criteria
		Section 5	1.0m from façade (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 13487:2003		
	Justification	The site has yet to be developed or the source installed.		
	Background Measurement	Measured within Lamp post on Lincoln Ave (Equivalent Position)		
3)	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.		
5)	Relative Distances	The plant is located approximately 17.9m 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 th August 2013	15 th August 2013	20 th August 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	14 th May 2013
	Background Measurements	17 th March 2014

7.8 H) Specific Noise Levels

1)	Residual Noise Level	Day Time (07:00 – 23:00)	Night Time (23:00 to 07:00)
		Manufacturers Data Supplied	Manufacturers Data Supplied
2)	Residual Noise Level	Not required	Not required
	Method of Determination	Not Applicable	
3)	Specific Noise Level	L _{Aeq, 1 hour} 33 dB	L _{Aeq, 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)
		$L_{Aeq,1\text{ hour}} 33$ dB	$L_{Aeq,5\text{ min}} 33$ 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	$L_{Aeq,1\text{ hour}} 33$ dB	$L_{Aeq,5\text{ min}} 33$ dB

7.12 L) Background Noise Levels

1)	Background Noise Levels	Day Time	Night Time
		(07:00 – 23:00)	(23:00 to 07:00)
		$L_{A90,16\text{ hour}} 53$ dB	$L_{A90,8\text{ hour}} 43$ dB
	Assessment Position	Residential Property above site	
	Justification	Residential façade not accessible	

7.13 M) Excess of Rating over Background Level

1)	Assessment	Day Time	Night Time
		(07:00 – 23:00)	(23:00 to 07:00)
		-20 dB	-10 dB
2)	Conclusion	below 'Complaints Unlikely'	below 'Complaints Unlikely'

8 APPENDIX B – SITE LAYOUT / PHOTOGRAPHS

8.1 Site Location



Proposed Source Location:	Latitude:	50.786667°	Longitude:	-0.719335°	Elevation:	0.0m
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Front of site



Delivery to site

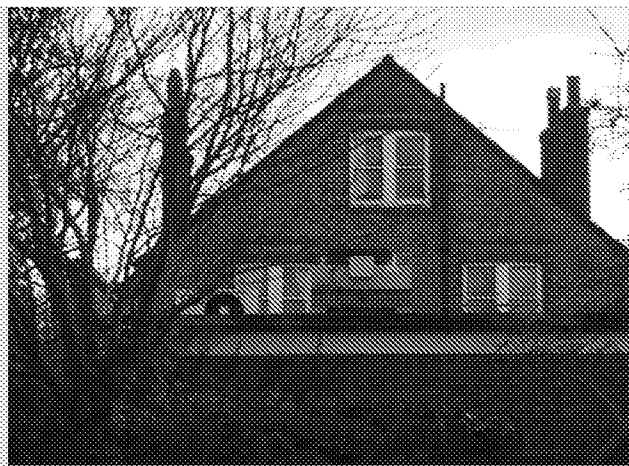
8.2 Assessment Position



Assessment position 1:	Latitude: 50.786636°	Longitude: -0.719323°	Elevation: 5.0m
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Front of residential property



Rear of residential property

8.3 Background Measurement Position



Background Measurement:

Latitude:

50.786724°

Longitude:

-0.718818°

Elevation:

4m

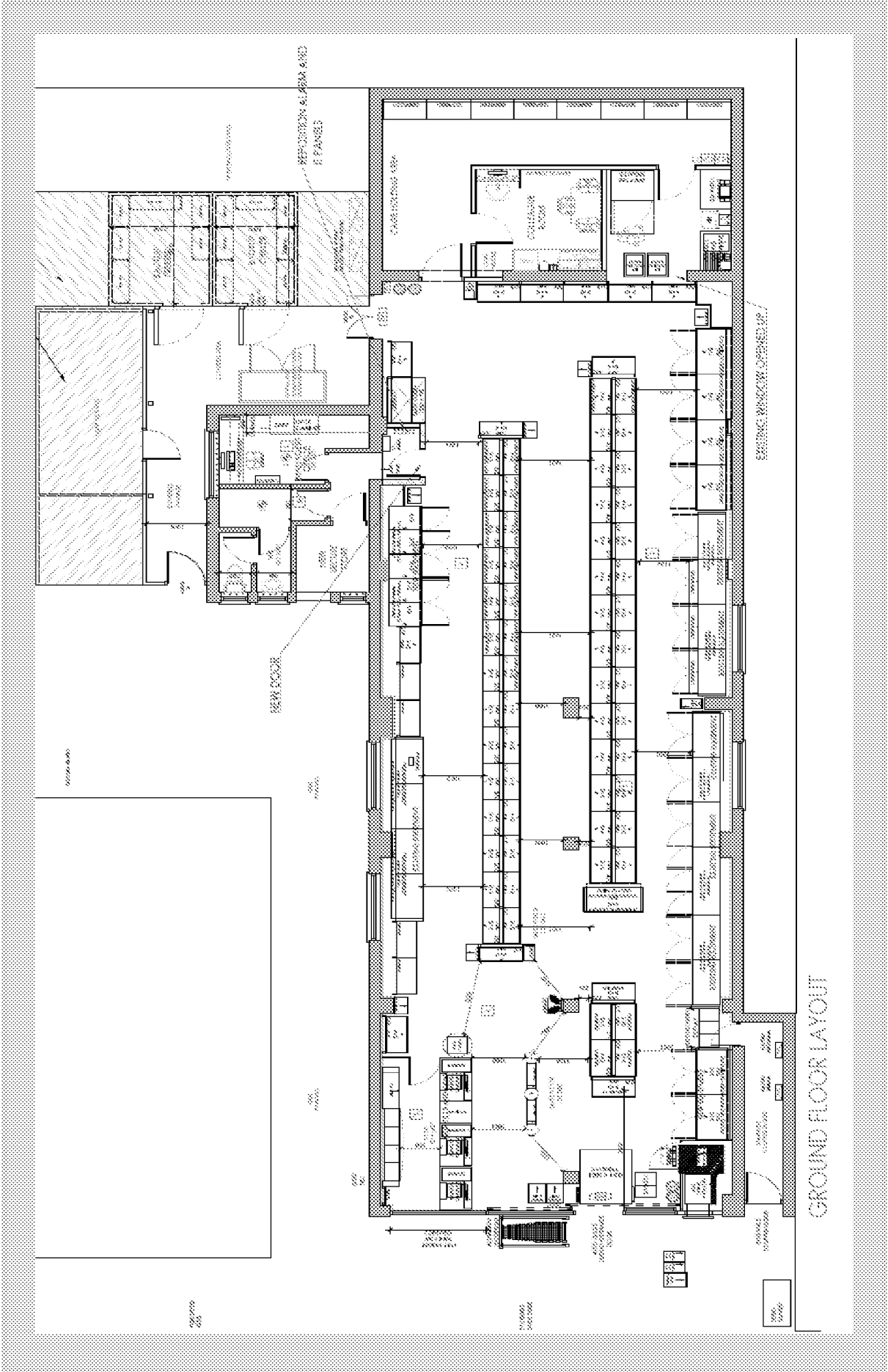


Lamp post on Lincoln Avenue



Lincoln Avenue

8.4 Supplied Drawings

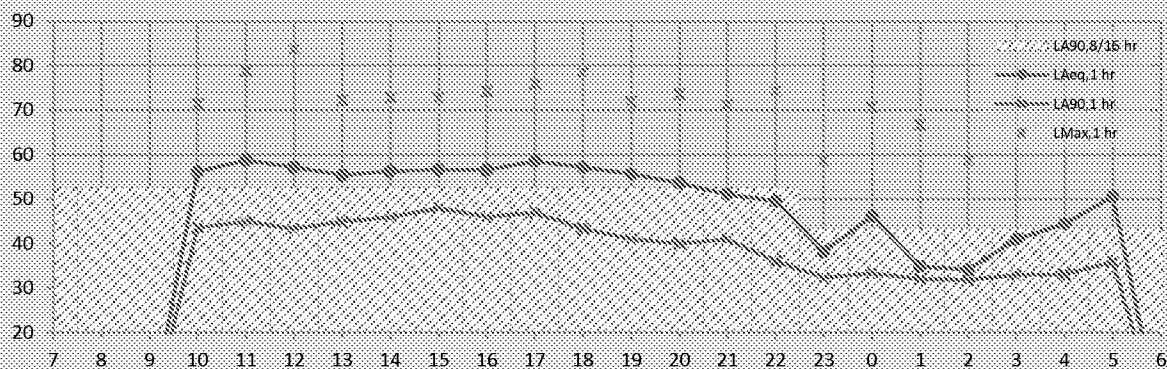




9 APPENDIX C - BACKGROUND NOISE LEVELS

9.1 10:00 Monday 17th March 2014 to 07:00 Tuesday 18th March 2014

Time Period	L _{Max}	Minimum 5 minute			1 Hour			Day and Night		
		L _{Aeq} , 5 min	L _{A10} , 5 min	L _{A90} , 5 min	L _{Aeq} , 1 hour	L _{A10} , 1 hour	L _{A90} , 1 hour	L _{Aeq} , t	L _{A10} , t	L _{A90} , 16 hours
07:00 – 08:00	--	--	--	--	--	--	--	57.8	59.0	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	83.7	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	44.9			
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	58.3	47.9			
16:00 – 17:00	74.2	51.1	52.3	44.2	56.5	57.7	46.0			
17:00 – 18:00	75.8	55.7	56.5	44.3	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	55.6	56.6	41.0	52.0	49.9	43.2
20:00 – 21:00	73.6	48.9	47.0	35.2	53.6	52.7	39.9			
21:00 – 22:00	71.3	45.6	44.6	38.7	51.0	48.7	40.9			
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	66.7	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	40.9	35.7	32.9			
04:00 – 05:00	77.6	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	52.0	35.8			
06:00 – 07:00										



Sound Pressure Levels, dB. Reference level of $2 \times 10^{-5} \text{ Nm}^{-2}$



9.2 Minimum Levels Table

Time	L _{Max}	Minimum 5 minute		Minimum 1 hour		Minimum Day and Night	
		L _{Aeq,t}	L _{A90,t}	L _{Aeq,t}	L _{A90,t}	L _{Aeq,t}	L _{A90,t}
07:00 – 23:00	83.7	38.4	33.7	49.5	36.0	57.8	52.6
23:00 – 07:00	77.6	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 = 16 and 8 hours	
Sound Pressure Levels, dB. Reference level of 2 x 10 ⁻⁵ Nm ⁻²							

9.3 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	62%	1017	10.0	--	West	7.2
	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

10 APPENDIX D – SOUND POWER LEVELS

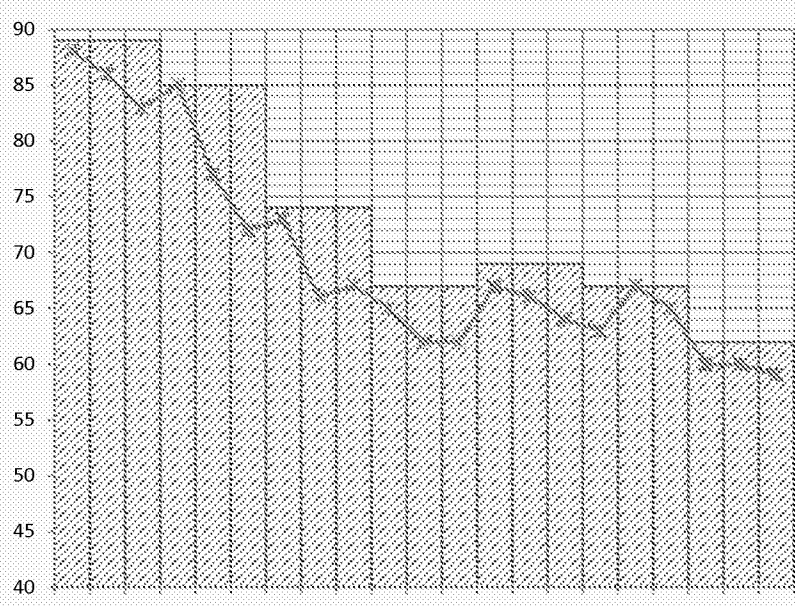
10.1 Day Time (07:00 – 23:00)

10.1.1 Gunter Evaporator

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

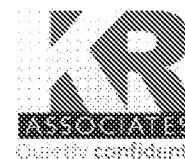
British Standard 13487: 2003 (Engineering Grade – BS EN ISO 3744:2010)

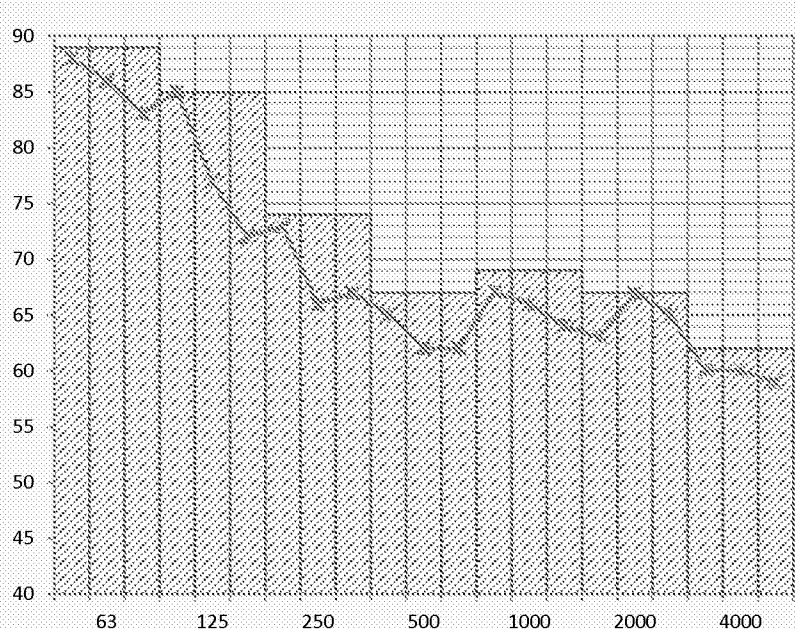


Manufacturer		Model	Conditions					
Gunter		S-GDF020.1C/27-AN150.E	Not provided by Manufacturer					
Location of Tests		Not provided by Manufacturer						
Date of Tests		14 th May 2013						
Background Noise Correction, K ₁		Not provided by Manufacturer						
Environmental Correction, K ₂		Not provided by Manufacturer						
Frequency (Hz)	L _w							
50	88							
63	86							
80	83							
100	85							
125	77							
160	72							
200	73							
250	66							
315	67							
400	65							
500	62							
630	62							
800	67							
1000	66							
1250	64							
1600	63							
2000	67							
2500	65							
3150	60	63	125	250	500	1000	2000	4000
4000	60	89	85	74	67	69	67	62
5000	59	Sound Power Level, L _w . Reference 1 x 10 ⁻¹² watts						
L _w (A)		75 dB		Sound power level (Engineering Grade). Reference 1 x 10 ⁻¹² watts				
Test Laboratory:		4193 – Tests not covered by KR Associates (UK) Ltd scope of accreditation						
Report Reference:		KR03715 / 03						
Test Date:		14 th May 2013						
Approval Date:		20 th May 2013						

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-GDF020.1C/27-AN150.E	Not provided by Manufacturer					
Location of Tests		Not provided by Manufacturer						
Date of Tests		14 th May 2013						
Background Noise Correction, K ₁		Not provided by Manufacturer						
Environmental Correction, K ₂		Not provided by Manufacturer						
Frequency (Hz)	L _{W(A)}	 The graph shows the sound power level spectrum for the Gunter evaporator. The y-axis represents the sound power level L_w(A) in dB, ranging from 40 to 90. The x-axis represents the octave band centre frequency in Hz, on a logarithmic scale from 63 to 4000. The spectrum shows a peak of 88 dB at 50 Hz, followed by a general downward trend with some fluctuations, reaching 59 dB at 5000 Hz. A shaded area under the curve indicates the sound power level across the frequency range.						
50	88							
63	86							
80	83							
100	85							
125	77							
160	72							
200	73							
250	66							
315	67							
400	65							
500	62							
630	62							
800	67							
1000	66							
1250	64							
1600	63							
2000	67							
2500	65							
3150	60	63	125	250	500	1000	2000	4000
4000	60	89	85	74	67	69	67	62
5000	59	Sound Power Level, L _W , Reference 1 x 10 ⁻¹² watts						
L _{W(A)}		75 dB		Sound power level (Engineering Grade). Reference 1 x 10 ⁻¹² watts				
Test Laboratory:		4193 - Tests not covered by KR Associates (UK) Ltd scope of accreditation						
Report Reference:		KR03715 / 04						
Test Date:		14 th May 2013						
Approval Date:		20 th May 2013						

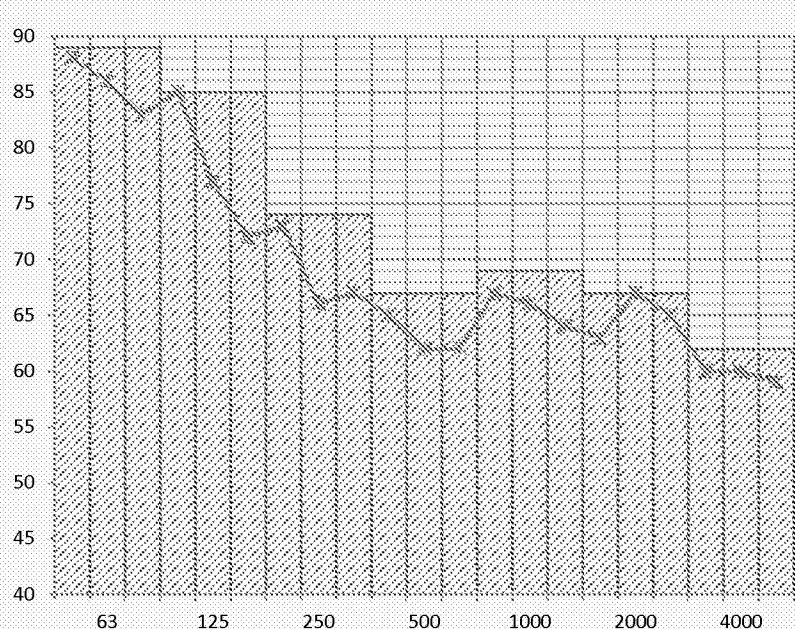
10.2 Night Time (23:00 – 07:00)

10.2.1 Gunter Evaporator

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

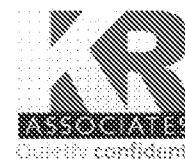
British Standard 13487: 2003 (Engineering Grade – BS EN ISO 3744:2010)

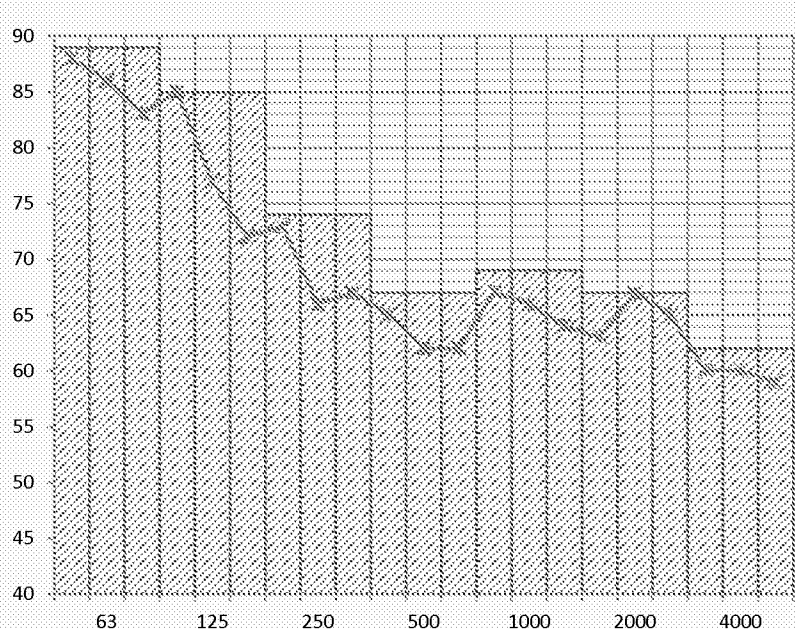


Manufacturer		Model	Conditions					
Gunter		S-GDF020.1C/27-AN150.E	Not provided by Manufacturer					
Location of Tests		Not provided by Manufacturer						
Date of Tests		14 th May 2013						
Background Noise Correction, K ₁		Not provided by Manufacturer						
Environmental Correction, K ₂		Not provided by Manufacturer						
Frequency (Hz)	L _w							
50	88							
63	86							
80	83							
100	85							
125	77							
160	72							
200	73							
250	66							
315	67							
400	65							
500	62							
630	62							
800	67							
1000	66							
1250	64							
1600	63							
2000	67							
2500	65							
3150	60							
4000	60							
5000	59							
		Octave Band Centre Frequency (Hz)						
		63	125	250	500	1000	2000	4000
		89	85	74	74	67	67	62
		Sound Power Level, L _w . Reference 1 x 10 ⁻¹² watts						
L _w (A)		75 dB		Sound power level (Engineering Grade). Reference 1 x 10 ⁻¹² watts				
Test Laboratory:		4193 - Tests not covered by KR Associates (UK) Ltd scope of accreditation						
Report Reference:		KR03715 / 07						
Test Date:		14 th May 2013						
Approval Date:		20 th May 2013						

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-GDF020.1C/27-AN150.E	Not provided by Manufacturer					
Location of Tests		Not provided by Manufacturer						
Date of Tests		14 th May 2013						
Background Noise Correction, K ₁		Not provided by Manufacturer						
Environmental Correction, K ₂		Not provided by Manufacturer						
Frequency (Hz)	L _{W(A)}							
50	88							
63	86							
80	83							
100	85							
125	77							
160	72							
200	73							
250	66							
315	67							
400	65							
500	62							
630	62							
800	67							
1000	66							
1250	64							
1600	63							
2000	67							
2500	65							
		Octave Band Centre Frequency (Hz)						
3150	60	63	125	250	500	1000	2000	4000
4000	60	89	85	74	67	69	67	62
5000	59	Sound Power Level, L _W , Reference 1 x 10 ⁻¹² watts						
L _{W(A)}		75 dB		Sound power level (Engineering Grade). Reference 1 x 10 ⁻¹² watts				
Test Laboratory:		4193 - Tests not covered by KR Associates (UK) Ltd scope of accreditation						
Report Reference:		KR03715 / 08						
Test Date:		14 th May 2013						
Approval Date:		20 th May 2013						

11 APPENDIX E – MINIMUM BACKGROUND ASSESSMENT (OUTSIDE UKAS SCOPE OF ACCREDITATION)

11.1 Maximum Source Data

The assessments under British Standard 4142:1997 are based on the maximum noise levels from the plant at an ambient temperature of 32°C during the day time period 07:00 to 23:00 hours and 25°C during the night time period 23:00 to 07:00 hours. In line with the specific requirements of British Standard 4142:1997 the 16 hour day time and 8 hour night time background noise levels are therefore used to give a fair and representative assessment.

11.2 Minimum Background Noise Levels

It is the requirement of some Local Authorities to use the minimum 1 hour background noise level during the day time and the minimum 5 minute background noise level during the night time. The following assessments are based on these background noise levels and use the proposed source levels that are likely to exist during these quiet periods.

British Standard 4142:1997	Day Time (Lowest 1 hour Reading)	Night Time (Lowest 5 minute Reading)
Section 7	22:00 – 23:00	02:00 – 03:00
Background Noise Levels	$L_{A90,1\text{ hour}}$ 36dB	$L_{A90,1\text{ hour}}$ 31 dB

11.3 Maximum Ambient Temperatures

The following table indicates the maximum ambient temperatures that are likely to exist on not more than 3 days every year.

Day Time Period																Night Time Period							
07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06
25	27	28	29	30	31	32	32	32	32	32	31	30	28	26	25	25	23	22	22	22	22	22	23
Maximum Ambient Temperature °C																							

11.4 Revised Source Noise Levels

The following noise levels are determined from the maximum ambient temperature that is likely to exist in the hour when the minimum background noise levels are likely to exist. Overall, as the ambient temperatures drop the refrigeration and air conditioning equipment will not have to work as hard to reject the overall duty.

British Standard 4142:1997	Day Time (Lowest 1 hour Reading)		Night Time (Lowest 5 minute Reading)	
Section 8 Rating Noise Levels	22:00 – 23:00		02:00 – 03:00	
	Ambient Temperature	25 °C	Ambient Temperature	22 °C
	$L_{Aeq,1\text{ hours}}$ 30 dB		$L_{Aeq,1\text{ hours}}$ 31 dB	

11.5 Revised Assessments

11.5.1 Day Time (Minimum 1 hour – 22:00 to 23:00)

Source	Operating Times	Source Position	
Gunter Evaporator	24 hours per day	Located within dedicated plant area.	
Gunter Evaporator			
Assessment Position	Residential Property above site		
Background Position	Lamp post on Lincoln Ave		
Distance	17.9m from the edge of the source to the assessment position.		
Item	Calculation	Clause	Commentary
Specific Noise Level <i>L_{aeq, 1 hour}</i>	30 dB	6.3	Specific noise level was calculated from measurements made at 1m ISO 9613:1996 ⁽¹⁾ .
Acoustic Feature Correction	+ 0 dB	8.2.	Reference section 8.2 of BS4142:1997.
Rating Level	30 dB	8.3.	The acoustic feature correction is added to the specific noise level to obtain the rating level.
Background Noise Level	36 dB	7.1.	The background noise level was measured at an equivalent position.
Assessment Level	-6 dB	9	The background level is subtracted from the rating level. (Numerical values)
Conclusion BS 4142:1997 ⁽¹⁾	Complaint Likely – Assessment of around +10 dB Complaints Marginal – Assessment of around +5 dB Complaints Unlikely – Assessment of around -10 dB or less		
Assessment	-6 dB		
Conclusion	The assessment level is below 'Marginal Significance'		
Test Laboratory:	4193		
Report Reference:	KR03715/ 11		
Test Date:	17 th March 2014 to 18 th March 2014		
Approval Date:	2 nd April 2014		

11.5.2 Night Time (Minimum 5 minute – 02:00 to 03:00)



4193

Rating Industrial Noise affecting Mixed Industrial and Residential Areas

British Standard 4142:1997 Night Time (23:00 to 07:00)



Source	Operating Times		Source Position
Gunter Evaporator	24 hours per day		Located within dedicated plant area.
Gunter Evaporator			
Assessment Position	Residential Property above site		
Background Position	Lamp post on Lincoln Ave		
Distance	17.9m from the edge of the source to the assessment position.		
Item	Calculation	Clause	Commentary
Specific Noise Level <i>L_{Aeq,5 minutes}</i>	31 dB	6.3	Specific noise level was calculated from measurements made at 1m ISO 9613:1996 ^[1] .
Acoustic Feature Correction	+ 0 dB	8.2.	Reference section 8.2 of BS4142:1997.
Rating Level	31 dB	8.3.	The acoustic feature correction is added to the specific noise level to obtain the rating level.
Background Noise Level	31 dB	7.1.	The background noise level was measured at an equivalent position.
Assessment Level	0 dB	9	The background level is subtracted from the rating level. (Numerical values)
Conclusion BS 4142:1997 ^[1]	Complaint Likely – Assessment of around +10 dB Complaints Marginal – Assessment of around +5 dB Complaints Unlikely – Assessment of around -10 dB or less		
Assessment	0 dB		
Conclusion	The assessment level is below 'Marginal Significance'		
Test Laboratory:	4193		
Report Reference:	KR03715 / 12		
Test Date:	17 th March 2014 to 18 th March 2014		
Approval Date:	2 nd April 2014		

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

12.1 Guidelines for Community Noise (World Health Organisation)

12.1.1 Criteria

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

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Specific Environment	Critical health effect(s)	$L_{Aeq,1}$ dB	Time Base (Hours)	$L_{Amax, fast}$ dB
Outside Bedrooms	Sleep disturbance, window open (Outdoor Values)	45	8	60
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside Bedrooms	Sleep disturbance, night time	30	8	45

12.1.2 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



Source	Operating Times		Source Position
Gunter Evaporator	24 hours per day		Located within dedicated plant area
Gunter Evaporator			
Assessment Position	Residential Property above site		
Item	L _{Aeq,16 hours}		Commentary.
Sound Pressure Level 1m from residential facade	33 dB(A)		External 1m from the residential façade.
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.

12.1.3 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		Located within dedicated plant area
Gunter Evaporator			
Assessment Position	Residential Property above site		
Item	L _{Aeq,8 hours}	L _{Amax,fast}	Commentary.
Sound Pressure Level 1m from residential facade	33 dB	40 dB	External 1m from the residential façade.
Sleep disturbance windows open (Outdoor Values)	45 dB	60 dB	Absolute External Criteria.
Compliance with Criteria	Yes	Yes	The calculated levels fall below the absolute criteria levels.

12.2 Night Noise Guidelines (World Health Organisation - Europe)

12.2.1 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 _{Amax,inside}	35
	Motility, onset of motility	L _{Amax,inside}	32
	Changes in duration of various stages of sleep, in sleep structure and fragmentation of sleep	L _{Amax,inside}	35
Sleep Quality	Waking up in the night and/or too early in the morning	L _{Amax,inside}	42
	Increased average motility when sleeping	L _{Night,outside}	42
Well Being	Self-reported sleep disturbance	L _{Night,outside}	42
	Use of somnifacient drugs	L _{Night,outside}	40
Medical Conditions	Environmental insomnia	L _{Night,outside}	42

12.2.2 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		Located within dedicated plant area
Gunter Evaporator			
Assessment Position	Residential Property above site		
Item	L _{Aeq,8 hours}	L _A Max,fast	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.



13 REFERENCES

13.1 British Standard 4142: 1997

Rating industrial noise affecting mixed residential and industrial areas.

13.2 British Standard 13487: 2003

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

13.3 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.

13.4 International Standard Organisation 9613 – Part 2: 1996

Acoustics – Attenuation of sound during propagation outdoors.

13.5 World Health Organisation Guidelines for Community noise: 1999

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

13.6 World Health Organisation Europe Night Noise Guidelines 2009

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