4193

Rating of Industrial Noise affecting Mixed Industrial and Residential Areas

British Standard 4142:1997

Site Name:	Deansgate Manchester
Address:	Former Staples Store, 118 Deansgate, Manchester, M3 2GQ.
Customer Name:	Tesco Stores Ltd
Address:	Tesco House, Delamere Road, Cheshunt, Hertfordshire, EN8 9SL.

KR Associates (UK) Ltd
Unit 2, Vancouver Wharf,
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Report Reference:	KR03427
Report Version:	v1.6
Version Date:	7th October 2014
Test Date:	10th October 2013
Consultant:	Mr. J. D. Earwood

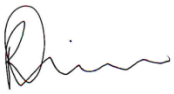
4193 Accredited to ISO/IEC 17025:2005	**Schedule of Accreditation** Issued by **United Kingdom Accreditation Service** 21 – 47 High Street, Feltham, Middlesex, TW13 4UN. **KR Associates (UK) Ltd** Issue No: 007 Issue Date: 25 May 2012		
Material / Products Tested	Type of Tests / Properties Measured / 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
KR03427 v1.0 (Full)	11th November 2013	Initial Issue of Report	Mr. R. M. Scrivener
KR03427 v1.1 (Full)	17th November 2013	Inclusion of Deliveries / Opening of Store	Mr. R. M. Scrivener
KR03427 v1.2 (Full)	26th November 2013	Inclusion of Deliveries / Opening of Store	Mr. R. M. Scrivener
KR03427 v1.3 (Full)	9th January 2014	Revise minor errors	Mr R M Scrivener
KR03427 v1.4 (Full)	23rd April 2014	Revise Plant Position	Mr J D Earwood
KR03427 v1.6 (Full)	7th October 2014	Reflects plant changes	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, MIOA

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1 EXECUTIVE SUMMARY

1.1 Instruction

KR Associates (UK) Ltd have been instructed by Tesco Stores Ltd to undertake an environmental noise survey at the proposed store at Former Staples Store, 118 Deansgate, Manchester to support the planning application.

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 Rating Noise Levels	07:00 – 23:00	23:00 – 07:00
	$L_{Aeq,1\ hours}$ 47 dB	$L_{Aeq,5\ minutes}$ 39 dB

1.3.2 Background Noise Levels

British Standard 4142:1997	Day Time	Night Time
Section 7 Background Noise Levels	07:00 – 23:00	23:00 – 07:00
	$L_{A90,16\ hours}$ 55 dB	$L_{A90,8\ hours}$ 45 dB

1.3.3 BS4142:1997 Assessment

British Standard 4142:1997	Day Time	Night Time
Section 9 Assessment Likelihood of Complaints	07:00 – 23:00	23:00 – 07:00
	-8	-6
	below 'Marginal Significance'	below 'Marginal Significance'

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 the Searle (550 rpm) 2 Fan Condenser, Mitsubishi Heavy Main AC, 0 0 and 0 0 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 at the residential Property on the top floor of building located between 7.7m and 16.1m 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 on the top floor of building 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. Residential façade not accessible, levels taken at an equivalent position at low level on Bridge Street.

2.4.2 Equivalent Position

The background noise levels were measured at the equivalent position located on Bridge Street between 10/10/2013 and 11/10/2013.

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		Audible at Number 64 Northbrook Crescent	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	$L_{Aeq,1\ hour}$ 67 dB	$L_{Aeq,5\ minutes}$ 65 dB
Maximum Specific Noise Levels	$L_{Aeq,1\ hour}$ 44 dB	$L_{Aeq,5\ minutes}$ 37 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."*

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		
Searle (550 rpm) 2 Fan Condenser	82.9	75.3	70.3	68.8	64.6	56.1	51.5	69.0	dB
Mitsubishi Heavy Main AC	84.0	80.0	69.0	62.0	64.0	62.0	57.0	70.1	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		
Searle (550 rpm) 2 Fan Condenser	77.9	70.3	65.3	63.8	59.6	51.1	46.5	64.0	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
$A_{div} = 20 . Log_{10} (d/d_0) +11$	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**
$A_{bar} = 10 . Log_{10} [3 + (40 . \delta / \lambda) - A_g]$ *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 Agr correction if Agr > 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 – (Searle (550 rpm) 2 Fan Condenser)

Searle (550 rpm) 2 Fan Condenser	Octave Band Centre Frequency (Hz)							Sum (A)	Units
	63	125	250	500	1000	2000	4000		
Sound Power Levels (L_w)	82.9	75.3	70.3	68.8	64.6	56.1	51.5	69.0	dB
Directivity (D_c)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	dB
Geometric Divergence (A_{div})	-28.7	-28.7	-28.7	-28.7	-28.7	-28.7	-28.7	--	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})	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	dB
Resultant Noise Levels (L_p)	57.2	49.6	44.6	43.1	38.9	30.4	25.8	44	dB
L_w - Sound Power Levels, L_w. BS EN ISO 13487:2003. Reference 1 x 10-12 watts. Lp - Sound Pressure Levels. Reference 2 x 10^{-5} Nm^{-2}									

4.3.2 Source 2 – (Mitsubishi Heavy Main AC)

Mitsubishi Heavy Main AC	Octave Band Centre Frequency (Hz)							Sum (A)	Units
	63	125	250	500	1000	2000	4000		
Sound Power Levels (L_w)	84.0	80.0	69.0	62.0	64.0	62.0	57.0	70.1	dB
Directivity (D_c)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	dB
Geometric Divergence (A_{div})	-28.8	-28.8	-28.8	-28.8	-28.8	-28.8	-28.8	--	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})	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	dB
Resultant Noise Levels (L_p)	58.2	54.2	43.2	36.2	38.2	36.2	31.2	44	dB
L_w - Sound Power Levels, L_w. BS EN ISO 13487:2003. Reference 1 x 10-12 watts. Lp - Sound Pressure Levels. Reference 2 x 10^{-5} Nm^{-2}									

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

4.4.1 Source 1 – (Searle (550 rpm) 2 Fan Condenser)

Searle (550 rpm) 2 Fan Condenser	Octave Band Centre Frequency (Hz)							Sum (A)	Units
	63	125	250	500	1000	2000	4000		
Sound Power Levels (L_w)	77.9	70.3	65.3	63.8	59.6	51.1	46.5	64.0	dB
Directivity (D_c)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	dB
Geometric Divergence (A_{div})	-28.7	-28.7	-28.7	-28.7	-28.7	-28.7	-28.7	--	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})	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	dB
Resultant Noise Levels (L_p)	52.2	44.6	39.6	38.1	33.9	25.4	20.8	39.3	dB
L_w - Sound Power Levels, L_w. BS EN ISO 13487:2003. Reference 1 x 10-12 watts. Lp - Sound Pressure Levels. Reference 2 x 10^{-5} Nm^{-2}									

5 ASSESSMENTS

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

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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
Searle (550 rpm) 2 Fan Condenser	24 hours per day		On roof at rear of site.
Mitsubishi Heavy Main AC	07:00 to 23:00		On roof at rear of site.
Assessment Position	Residential Property on the top floor of building		
Background Position	on Bridge Street		
Distance	7.7m and 16.1m from the edge of the source to the assessment position.		
Item	Calculation	Clause	Commentary
Specific Noise Level $L_{Aeq,\ 1\ hour}$	47 dB	6.3	Specific noise level was calculated from measurements made at 1m ISO 9613:1996[3].
Acoustic Feature Correction	+ 0 dB	8.2.	Reference section 8.2 of BS4142:1997.
Rating Level	47 dB	8.3.	The acoustic feature correction is added to the specific noise level to obtain the rating level.
Background Noise Level	55 dB	7.1.	The background noise level was measured at an equivalent position.
Assessment Level	-8 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	**-8 dB**		
Conclusion	**The assessment level is below 'Marginal Significance'**		
Test Laboratory:	4193		
Report Reference:	KR03427 / 01		
Test Date:	10/10/2013 - 11/10/2013		
Approval Date:	7th October 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
Searle (550 rpm) 2 Fan Condenser	24 hours per day		On roof at rear of site.
Mitsubishi Heavy Main AC	07:00 to 23:00		On roof at rear of site.
Assessment Position	Residential Property on the top floor of building		
Background Position	on Bridge Street		
Distance	7.7m and 16.1m from the edge of the source to the assessment position.		
Item	Calculation	Clause	Commentary
Specific Noise Level $L_{Aeq,5\ minutes}$	39 dB	6.3	Specific noise level was calculated from measurements made at 1m ISO 9613:1996[3].
Acoustic Feature Correction	+ 0 dB	8.2.	Reference section 8.2 of BS4142:1997.
Rating Level	39 dB	8.3.	The acoustic feature correction is added to the specific noise level to obtain the rating level.
Background Noise Level	45 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:	KR03427 / 02		
Test Date:	10/10/2013 - 11/10/2013		
Approval Date:	7th October 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

1)	Description of Source	Type	Manufacturer	Model
	Searle (550 rpm) 2 Fan Condenser	2 Fan Condenser	Searle (550 rpm)	MGA124 EC
	Mitsubishi Heavy Main AC	Main AC	Mitsubishi Heavy	FDC280KXRE6
2)	Description of Source	Source Location	Hours of Operation	Mode of Operation
	Searle (550 rpm) 2 Fan Condenser	On roof at rear of site.	24 hours per day	Continuously On Demand
3)	Mitsubishi Heavy Main AC	On roof at rear of site.	07:00 to 23:00	Continuously On Demand
4)	Description of Premises	Site based on busy main road on large commercial street. Residential Apartments located above Proposed plant is located on the roof of the building Large, primarily commercial area on busy main road		

7.2 B) Subjective Impression of Source at Assessment Position

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

7.3 C) Relative Positions

1)	Assessment Position	Residential Property on the top floor of building		
		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.		
3)	Background Measurement	Measured within on Bridge Street (Equivalent Position)		
	Justification	BS 4142:1997 Criteria	Details	Compliance with Criteria
		Section 5.3	3.5m to any reflecting surface	Does not comply with Criteria
		Section 5.3 – Note 1	Height 1.2m to 1.5m	Does not comply with Criteria
		Section 5.3 – Note 2	1st floor 1m to facade	Does comply with Criteria
		Section 5.3 – Note 3	Measurement Height	3.7
			Distance to Reflecting Surface	0.3
		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 between the source and receiver is flat, hard and reflective		
5)	Relative Distances	The plant is located approximately 7.7 - 5,987,836.7 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 33.3 ms-1
	Wind Direction	NW
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	14th May 2012
	Background Measurements	10th October 2013

7.8 H) Specific Noise Levels

1)	Residual Noise Level	Day Time	Night Time
		(07:00 – 23:00)	(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	$L_{Aeq,\ 1\ hour}$ 47 dB	$L_{Aeq,5\ minutes}$ 39 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)
		$L_{Aeq,1\ hour}$ 40 dB	$L_{Aeq,5\ min}$ 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	$L_{Aeq,1\ hour}$ 47 dB	$L_{Aeq,5\ min}$ 39 dB

7.12 L) Background Noise Levels

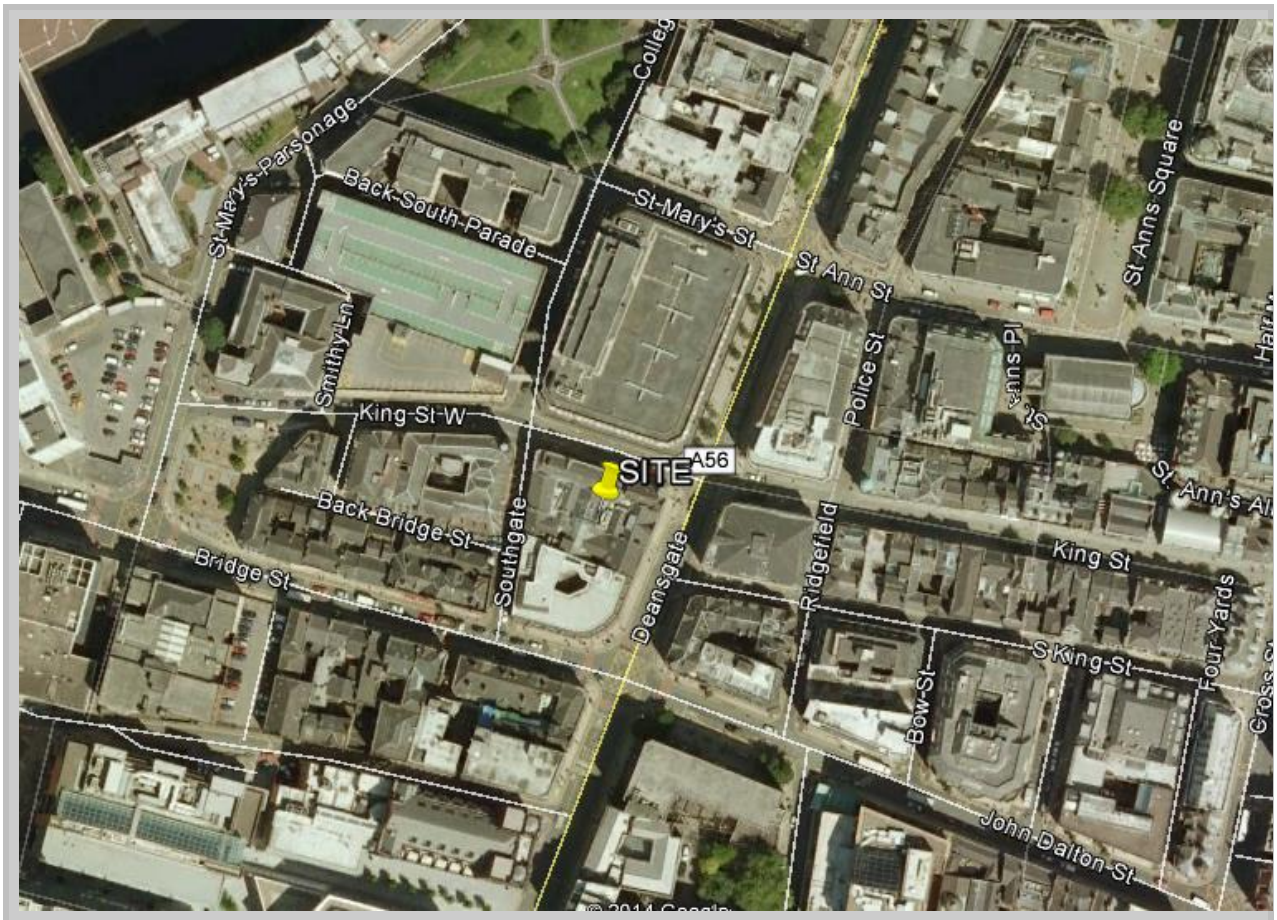
1)	Background Noise Levels	Day Time	Night Time
		(07:00 – 23:00)	(23:00 to 07:00)
		$L_{A90,16\ hour}$ 55 dB	$L_{A90,\ 8\ hour}$ 45 dB
	Assessment Position	Residential Property on the top floor of building	
	Justification	The ground between the source and receiver is flat, hard and reflective	

7.13 M) Excess of Rating over Background Level

1)	Assessment	Day Time	Night Time
		(07:00 – 23:00)	(23:00 to 07:00)
		-8 dB	-6 dB
2)	Conclusion	below 'Marginal Significance'	below 'Marginal Significance'

8 APPENDIX B – SITE LAYOUT / PHOTOGRAPHS

8.1 Site Location



Proposed Source Location:	Latitude:	53.481356°	Longitude:	-2.248343°	Elevation:	0.0m

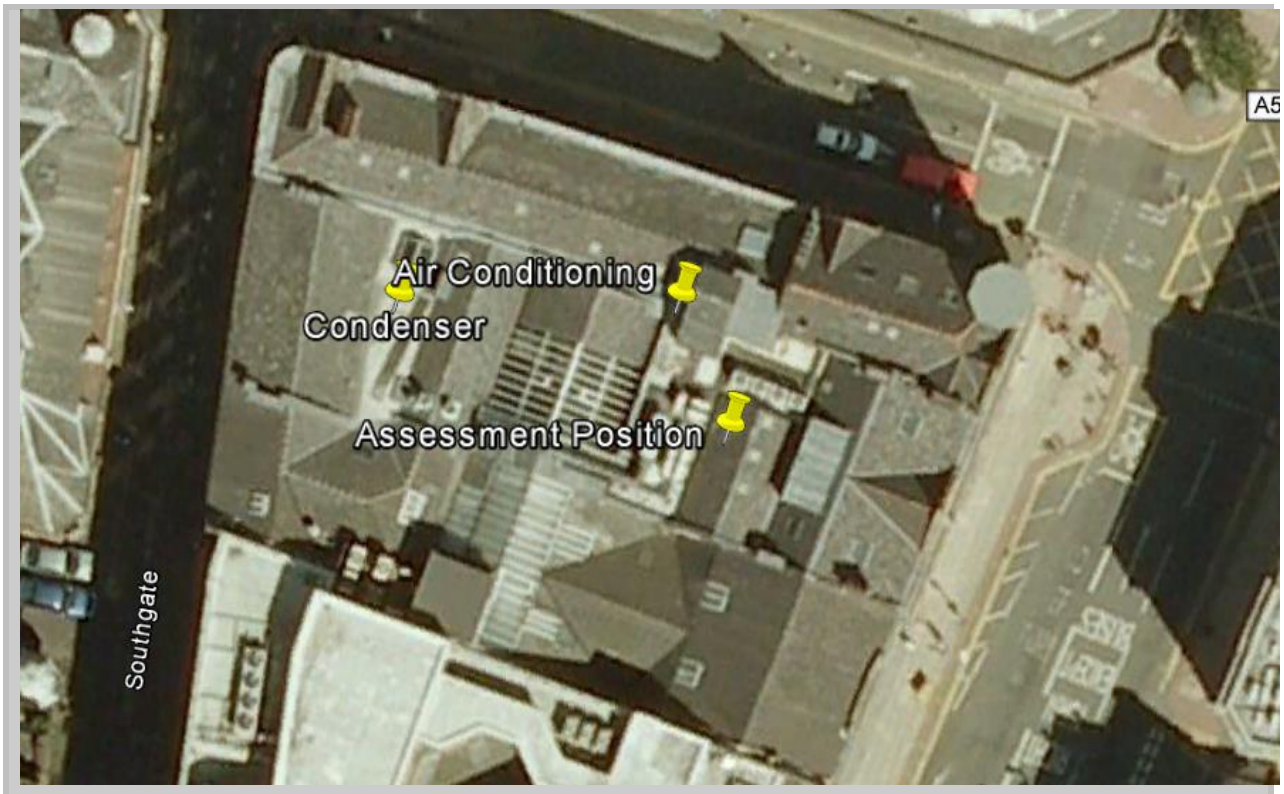


Front of site.



Side of site

8.2 Assessment Position

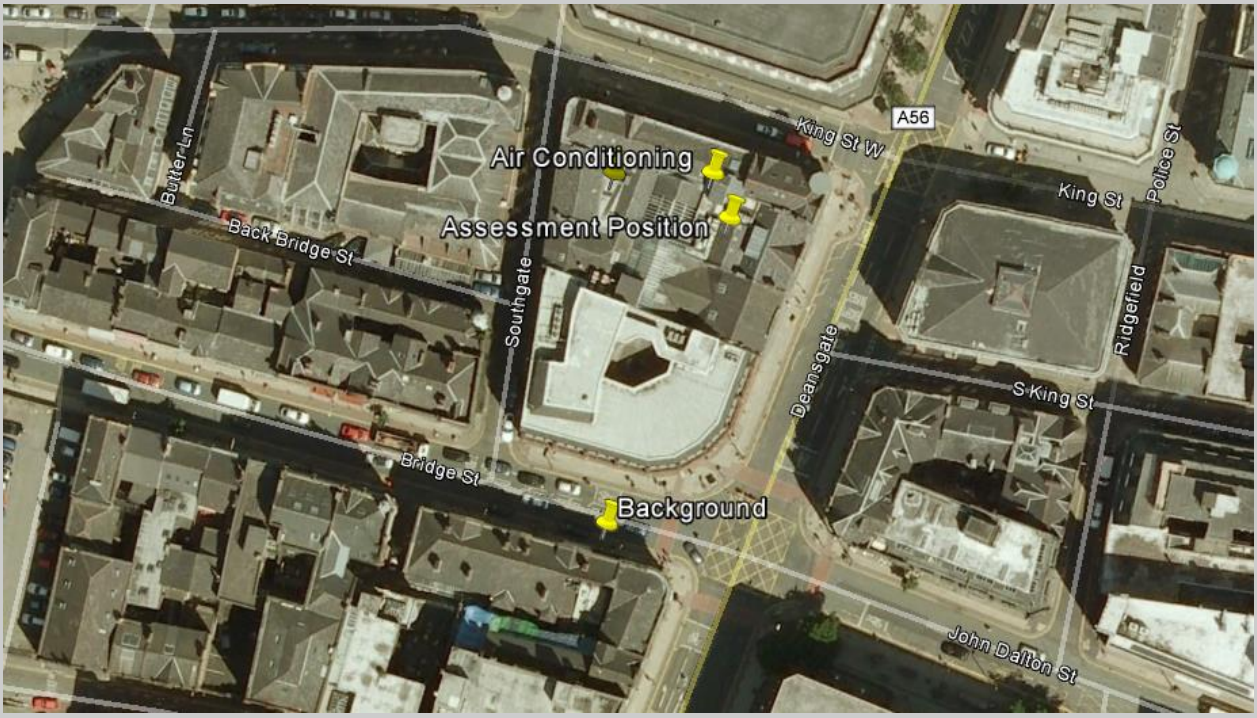


Assessment position 1:	Latitude:	53.481279°	Longitude:	-2.248062°	Elevation:	12.0m



Assessment position

8.3 Background Measurement Position

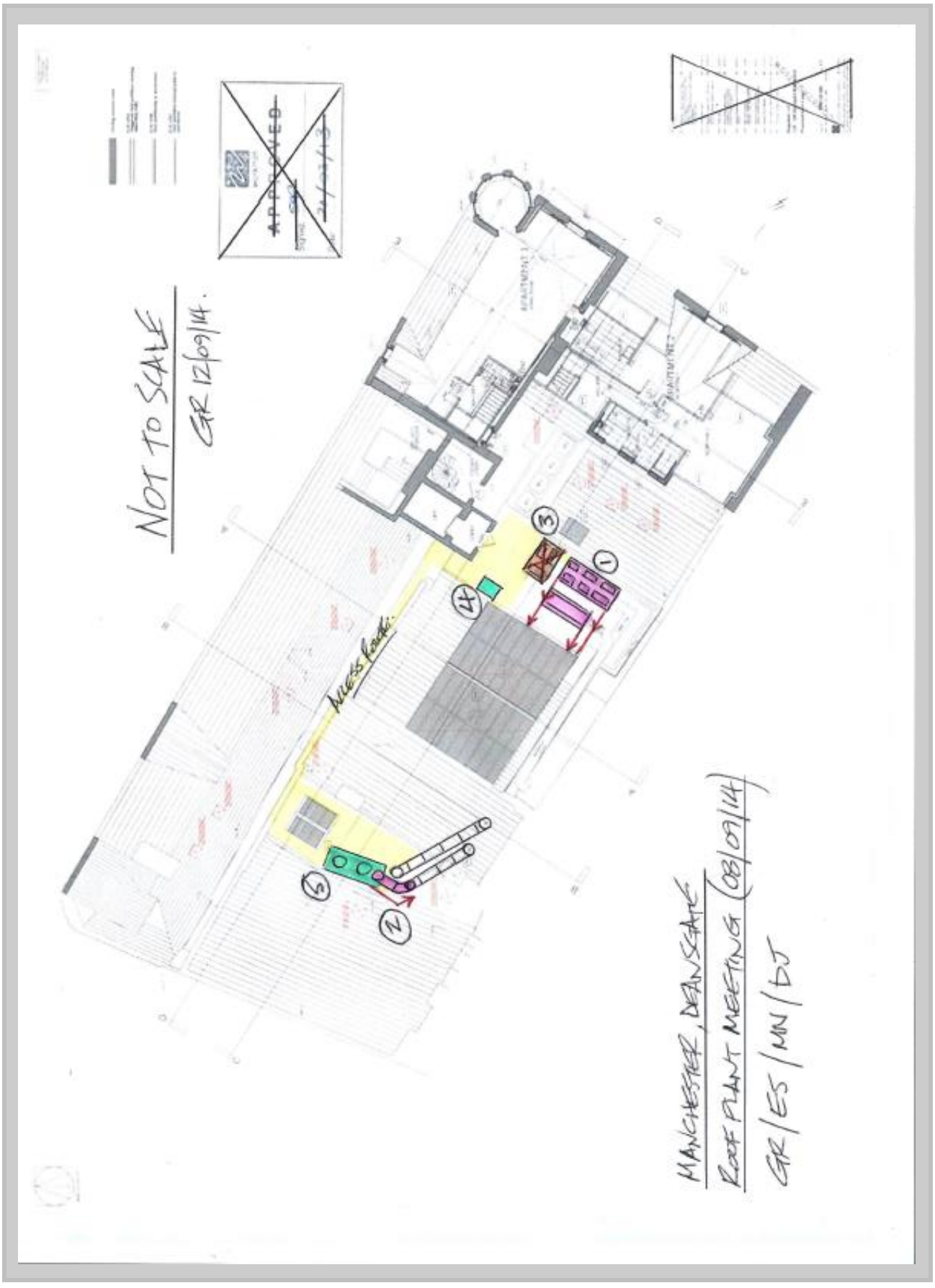


Background Measurement:	Latitude:	53.480835°	Longitude:	-2.248365°	Elevation:	4m
Background Position:	BackPos3					
Justification:	Residential façade not accessible					



Lamp post on Bridge Street

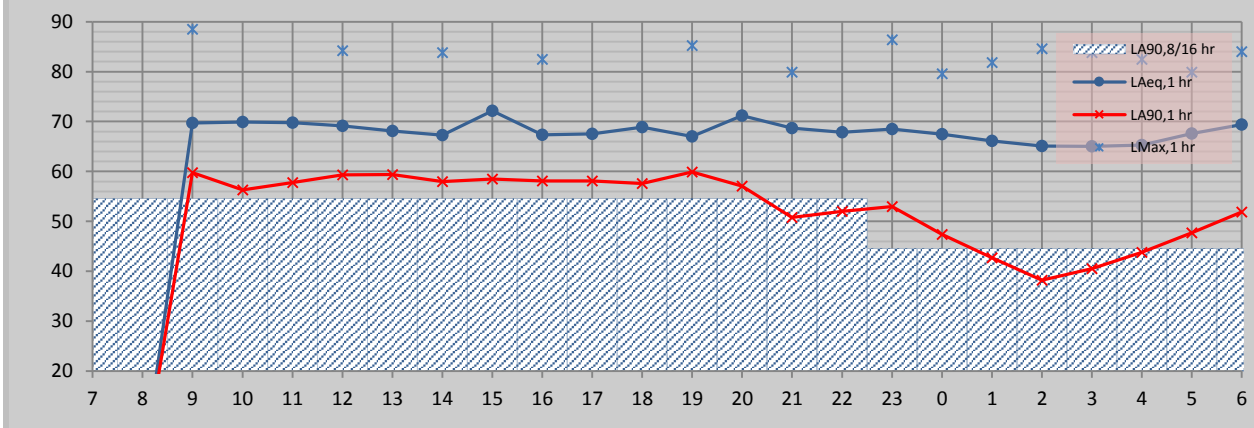
8.4 Supplied Sketch



9 APPENDIX C - BACKGROUND NOISE LEVELS

9.1 09:00 Thursday 10th October to 07:00 Friday 11th October

Time Period	L_{Max}	Minimum 5 minute			1 Hour			Day and Night		
		$L_{Aeq,5\ min}$	$L_{A10,\ 5\ min}$	$L_{A90,\ 5\ min}$	$L_{Aeq,\ 1\ hour}$	$L_{A10,\ 1\ hour}$	$L_{A90,\ 1\ hour}$	$L_{Aeq,\ t}$	$L_{A10,\ t}$	$L_{A90,\ 16hours}$
07:00 – 08:00	--	--	--	--	--	--	--	74	78.1	59.6
08:00 – 09:00	--	--	--	--	--	--	--			
09:00 – 10:00	93.5	73.2	75.5	61.2	74.7	76.7	64.8			
10:00 – 11:00	95.7	73.6	76.1	56.4	74.9	76.9	61.3			
11:00 – 12:00	98.9	73.0	75.4	58.9	74.8	76.5	62.8			
12:00 – 13:00	89.2	71.0	73.6	58.7	74.1	76.1	64.3			
13:00 – 14:00	95.4	71.3	74.0	63.2	73.1	75.1	64.4			
14:00 – 15:00	88.8	70.4	73.0	60.0	72.3	74.7	63.0			
15:00 – 16:00	99.8	71.4	73.9	60.7	77.1	75.7	63.5			
16:00 – 17:00	87.5	70.3	73.5	61.0	72.4	74.9	63.1			
17:00 – 18:00	95.1	70.3	71.8	61.2	72.5	74.8	63.1			
18:00 – 19:00	99.4	70.5	73.5	59.9	73.9	74.7	62.6			
19:00 – 20:00	90.2	70.0	72.4	63.1	72.0	74.1	64.9			
20:00 – 21:00	99.4	71.5	73.9	54.4	76.2	76.9	62.1			
21:00 – 22:00	86.9	74.8	76.8	52.3	75.7	77.8	57.8			
22:00 – 23:00	99.2	75.3	77.3	58.4	76.8	78.1	61.0			
23:00 – 00:00	94.4	75.4	77.9	55.4	76.5	78.6	61.0	75.1	78.5	52.6
00:00 – 01:00	87.6	74.7	77.3	52.3	75.5	78.2	55.4			
01:00 – 02:00	89.8	71.9	75.8	44.1	74.1	77.8	50.7			
02:00 – 03:00	92.6	70.6	74.4	42.5	73.1	77.1	46.2			
03:00 – 04:00	91.8	71.6	75.5	43.4	73.0	76.9	48.5			
04:00 – 05:00	90.5	70.7	74.6	46.3	73.3	77.4	51.8			
05:00 – 06:00	87.9	74.6	78.4	53.7	75.6	79.5	55.7			
06:00 – 07:00	92.0	75.7	79.2	54.6	77.4	80.1	59.9			



Sound Pressure Levels, dB. Reference level of 2 x 10^{-5} 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	94.8	65.0	45.3	67.0	50.8	69.0	54.6
23:00 – 07:00	86.4	62.6	34.5	65.0	38.2	67.1	44.6
	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 2×10^{-5} Nm^{-2}							

10 APPENDIX D – SOUND POWER LEVELS

10.1 Day Time (07:00 – 23:00)

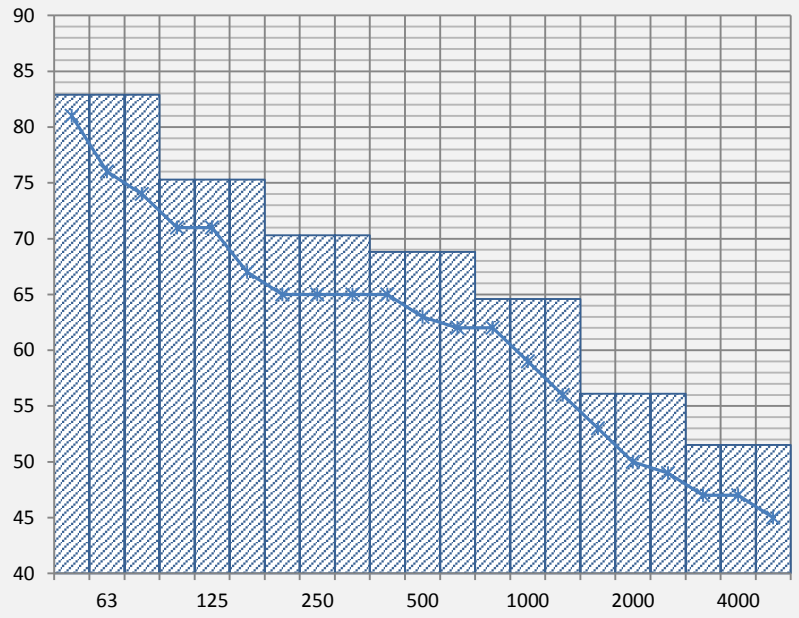
10.1.1 Searle (550 rpm) 2 Fan Condenser

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
Searle (550 rpm)	MGA124 EC	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	81
63	76
80	74
100	71
125	71
160	67
200	65
250	65
315	65
400	65
500	63
630	62
800	62
1000	59
1250	56
1600	53
2000	50
2500	49
3150	47
4000	47
5000	45



Octave Band Centre Frequency (Hz)						
63	125	250	500	1000	2000	4000
83	75	70	69	65	56	52

Sound Power Level, L_W. Reference 1 x 10^{-12} watts

$L_{W(A)}$	**69 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:	KR03427 / 03	
Test Date:	14th May 2012	
Approval Date:	20th May 2012	

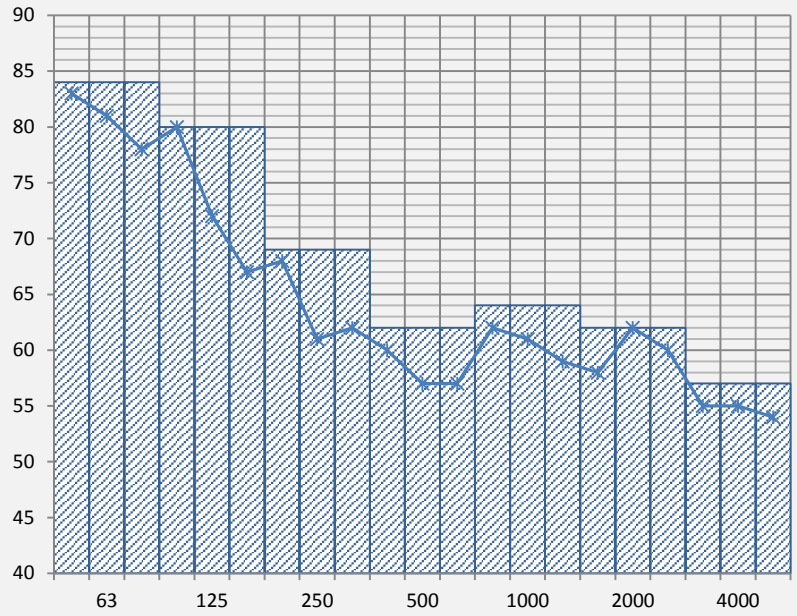
10.1.2 Mitsubishi Heavy Main AC

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
Mitsubishi Heavy	FDC280KXRE6	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)	$L_{W(A)}$
50	83
63	81
80	78
100	80
125	72
160	67
200	68
250	61
315	62
400	60
500	57
630	57
800	62
1000	61
1250	59
1600	58
2000	62
2500	60
3150	55
4000	55
5000	54



Octave Band Centre Frequency (Hz)

63	125	250	500	1000	2000	4000
84	80	69	62	64	62	57

Sound Power Level, L_W. Reference 1 x 10^{-12} watts

$L_{W(A)}$	**70 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:	KR03427 / 04	
Test Date:	14th May 2012	
Approval Date:	20th May 2012	

10.2 Night Time (23:00 – 07:00)

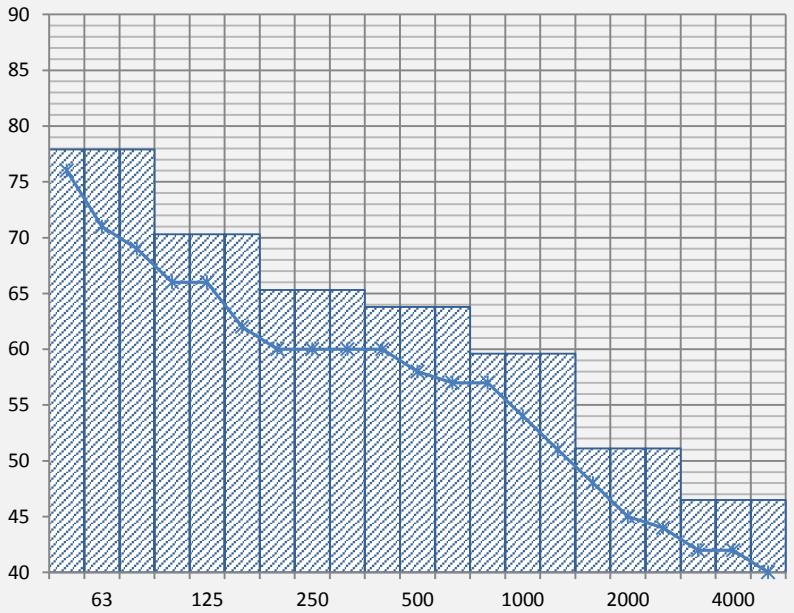
10.2.1 Searle (550 rpm) 2 Fan Condenser

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
Searle (550 rpm)	MGA124 EC	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	76
63	71
80	69
100	66
125	66
160	62
200	60
250	60
315	60
400	60
500	58
630	57
800	57
1000	54
1250	51
1600	48
2000	45
2500	44
3150	42
4000	42
5000	40



Octave Band Centre Frequency (Hz)						
63	125	250	500	1000	2000	4000
78	70	65	65	64	51	47

Sound Power Level, L_W. Reference 1 x 10^{-12} watts

$L_{W(A)}$	**64 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:	KR03427 / 07
Test Date:	14th May 2012
Approval Date:	20th May 2012

10.2.2 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
Searle (550 rpm) 2 Fan Condenser	24 hours per day		On roof at rear of site.
Mitsubishi Heavy Main AC	07:00 to 23:00		On roof at rear of site.
Assessment Position	Residential Property on the top floor of building		
Background Position	on Bridge Street		
Distance	7.7m and 16.1m from the edge of the source to the assessment position.		
Item	Calculation	Clause	Commentary
Specific Noise Level $L_{Aeq,5\ minutes}$	37 dB	6.3	Specific noise level was calculated from measurements made at 1m ISO 9613:1996[3].
Acoustic Feature Correction	+ 0 dB	8.2.	Reference section 8.2 of BS4142:1997.
Rating Level	37 dB	8.3.	The acoustic feature correction is added to the specific noise level to obtain the rating level.
Background Noise Level	35 dB	7.1.	The background noise level was measured at an equivalent position.
Assessment Level	2 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	**2 dB**		
Conclusion	**The assessment level is below 'Marginal Significance'**		
Test Laboratory:	4193		
Report Reference:	KR03427 / 12		
Test Date:	10/10/2013 - 11/10/2013		
Approval Date:	KR03427		

11 APPENDIX E – ADDITIONAL ASSESSMENTS (OUTSIDE UKAS SCOPE OF ACCREDITATION)

11.1 Guidelines for Community Noise (World Health Organisation)

11.1.1 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)	$L_{Aeq,t}$ 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

11.1.2 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
Searle (550 rpm) 2 Fan Condenser	24 hours per day		On roof at rear of site.
Mitsubishi Heavy Main AC	07:00 to 23:00		On roof at rear of site.
Assessment Position	Residential Property on the top floor of building		
Item	$L_{Aeq,16\ hours}$		Commentary.
Sound Pressure Level 1m from residential facade	47 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.

11.1.3 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
Searle (550 rpm) 2 Fan Condenser	24 hours per day		On roof at rear of site.
Mitsubishi Heavy Main AC	07:00 to 23:00		On roof at rear of site.
Assessment Position	Residential Property on the top floor of building		
Item	$L_{Aeq,8\ hours}$	$L_{AMax.fast}$	Commentary.
Sound Pressure Level 1m from residential facade	47 dB	54 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.

11.2 Night Noise Guidelines (World Health Organisation - Europe)

11.2.1 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

11.2.2 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
Searle (550 rpm) 2 Fan Condenser	24 hours per day		On roof at rear of site.
Mitsubishi Heavy Main AC	07:00 to 23:00		On roof at rear of site.
Assessment Position	Residential Property on the top floor of building		
Item	$L_{Aeq,8\ hours}$	$L_{AMax.fast}$	Commentary
Sound Pressure Level 1m from residential facade	47 dB	54 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.

12 REFERENCES

12.1 British Standard 4142: 1997

Rating industrial noise affecting mixed residential and industrial areas.

12.2 British Standard 13487: 2003

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

12.3 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.

12.4 International Standard Organisation 9613 – Part 2: 1996

Acoustics – Attenuation of sound during propagation outdoors.

12.5 World Health Organisation Guidelines for Community noise: 1999

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

12.6 World Health Organisation Europe Night Noise Guidelines 2009

-end-