4193

Rating of Industrial Noise affecting Mixed Industrial and Residential Areas

British Standard 4142:1997

Also Includes Assessment of Delivery Noise

Site Name:	Deansgate Manchester
Address:	Junction of Deansgate and King St , 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,

Hazel Road, Southampton, SO19 7BN.

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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** 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
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KR03427 v1.4 (Full)	23rd April 2014	Revise Plant Position	Mr J D Earwood
KR03427 v1.5 (Full)	30th April 2014	Inclusion of Deliveries / Opening of Store	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 the former Staples Store, 118 Deansgate, Manchester to support the planning application.

1.2 Scope of Report

1.2.1 Plant Noise

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.

1.2.2 Delivery Noise

Delivering the Goods published by the Department for Transport outlines a method for assessing the impact of deliveries to commercial properties on nearby residential properties. The general approach is very similar to the method outline in British Standard 4142:1997 as it compares the noise from deliveries to the underlying background noise levels.

1.2.3 Opening Hours

There is no specific standard for assessing the impact of the opening hours of a proposed retail store.

1.3 Plant Noise Conclusion

1.3.1 Rating Levels

British Standard 4142:1997	Day Time	Night Time	Early Morning
Section 8 Rating Noise Levels	07:00 – 23:00	23:00 – 06:00	06:00 – 07:00
	$L_{Aeq,1\ hours}$ 44 dB	$L_{Aeq,5\ minutes}$ 36 dB	$L_{Aeq,1\ hours}$ 44 dB

1.3.2 Background Noise Levels

British Standard 4142:1997	Day Time	Night Time	Early Morning
Section 7 Background Noise Levels	07:00 – 23:00	23:00 – 06:00	06:00 – 07:00
	$L_{A90,16\ hours}$ 55 dB	$L_{A90,8\ hours}$ 45 dB	$L_{A90,1\ hours}$ 59 dB

1.3.3 BS4142:1997 Assessment

British Standard 4142:1997	Day Time	Night Time	Early Morning
Section 9 Assessment Likelihood of Complaints	07:00 – 23:00	23:00 – 06:00	06:00 – 07:00
	-11	-9	-14
	below 'Complaints Unlikely'	below 'Marginal Significance'	below 'Complaints Unlikely'

1.3.4 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 Delivery Noise Conclusion

Detailed measurements were made of each of the elements of a typical delivery including the lorry arriving, leaving and manoeuvring, roller shutter door, movement of pallets / cages and general noise associated with deliveries. These levels were used to build the noise levels from a typical delivery and incorporated within the detailed 3D noise map. The calculations indicate that deliveries can be undertaken between 06:00 and 22:00 hours 7 days per week without having a negative impact on the local residential properties. The site layout has been optimised to reduce the noise impact from delivery noise. Consideration would need to be given to condition 3 of planning permission 081894/FU/2007 conditionally granted by Manchester City Council which contains current restrictions on delivery hours.

1.5 Open Hours of Store

Putting aside the noise related issues with respect to plant and deliveries there are no other noise related issues why the proposed Tesco Express store can't open between 06:00 and 23:00 7 days per week. Consideration would need to be given to condition 4 of planning permission 081894/FU/2007 conditionally granted by Manchester City Council which contains current restrictions on opening hours.

2 TEST PROCEDURE

2.1 Plant Noise

2.1.1 Scope of Report

This report sets out to determine if the installation of the Searle (350 rpm) 2 Fan Condenser, Mitsubishi Heavy Sales Floor AC, Mitsubishi Heavy Sales Floor AC and Mitsubishi Heavy Cash Office AC 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.

2.1.2 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.

2.1.3 Assessment Position

The assessment position was established as the residential property on the top floor of building located between 4.4m and 5.7m from the proposed refrigeration and air conditioning sources within the dedicated plant area.

2.1.4 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.

2.1.5 Calculations

The specific noise levels are calculated at the assessment position located 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.

2.1.6 Equivalent Position

The background noise levels were measured at the equivalent position located on the lamp post on Bridge Street between 09:00 on 10th October 2013 and 11th October 2013.

2.1.7 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 residential facade	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	$L_{Aeq,1\ hour}$ 52 dB	$L_{Aeq,5\ minutes}$ 32 dB

2.1.8 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.

2.2 Delivery Noise

The proposed deliveries are mapped using a 3D noise map and the results used to determine the impact of deliveries. These are compared against the underlying background noise levels at different times of the day to establish when deliveries will be acceptable

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 Planning Permission 08194/FU/2007

Manchester City Council granted planning permission under reference 08194/FU/2007 with the following two conditions which relate to noise.

Condition3

"Loading, unloading, deliveries, servicing and collections, including waste collections shall not take place outside the following hours: 07:30 to 20:00 Monday to Saturday; 10:00 to 18:00 Sundays and Bank Holidays."

Condition 4

"No part of the building marked Unit B tenancy shall be occupied until the opening hours of such part have been agreed in writing by the City Council as LPA. We will be submitting a DOC application to obtain 6am-11pm opening hours."

4 CALCULATION OF PLANT NOISE 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 Sales Floor AC	85.0	81.0	70.0	63.0	65.0	63.0	58.0	71.1	dB
Mitsubishi Heavy Sales Floor AC	85.0	81.0	70.0	63.0	65.0	63.0	58.0	71.1	dB
Mitsubishi Heavy Cash Office AC	78.0	73.0	63.0	55.0	55.0	53.0	50.0	62.5	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		
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 (350 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)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	--	dB
Geometric Divergence (A_{div})	-37.1	-37.1	-37.1	-37.1	-37.1	-37.1	-37.1	--	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})	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	dB
Resultant Noise Levels (L_p)	51.8	44.2	39.2	37.7	33.5	25.0	20.4	39	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 Sales Floor AC)

Mitsubishi Heavy Sales Floor AC	Octave Band Centre Frequency (Hz)							Sum (A)	Units
	63	125	250	500	1000	2000	4000		
Sound Power Levels (L_w)	85.0	81.0	70.0	63.0	65.0	63.0	58.0	71.1	dB
Directivity (D_c)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	--	dB
Geometric Divergence (A_{div})	-16.2	-16.2	-16.2	-16.2	-16.2	-16.2	-16.2	--	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})	-5.2	-5.5	-6.2	-7.2	-8.8	-10.8	-13.2	--	dB
Resultant Noise Levels (L_p)	69.6	65.3	53.6	45.6	46.0	42.0	34.5	53	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}									

4.3.3 Source 3 – (Mitsubishi Heavy Sales Floor AC)

Mitsubishi Heavy Sales Floor AC	Octave Band Centre Frequency (Hz)							Sum (A)	Units
	63	125	250	500	1000	2000	4000		
Sound Power Levels (L_w)	85.0	81.0	70.0	63.0	65.0	63.0	58.0	71.1	dB
Directivity (D_c)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	--	dB
Geometric Divergence (A_{div})	-21.0	-21.0	-21.0	-21.0	-21.0	-21.0	-21.0	--	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})	-5.2	-5.5	-6.2	-7.3	-8.8	-10.9	-13.4	--	dB
Resultant Noise Levels (L_p)	64.8	60.5	48.8	40.8	41.2	37.1	29.7	49	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}									

4.3.4 Source 4 – (Mitsubishi Heavy Cash Office AC)

Mitsubishi Heavy Cash Office AC	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_c)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	--	dB
Geometric Divergence (A_{div})	-15.8	-15.8	-15.8	-15.8	-15.8	-15.8	-15.8	--	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})	-6.4	0.0	0.0	0.0	0.0	0.0	0.0	--	dB
Resultant Noise Levels (L_p)	46.8	39.2	34.2	32.7	28.5	20.0	15.4	34	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 (350 rpm) 2 Fan Condenser)

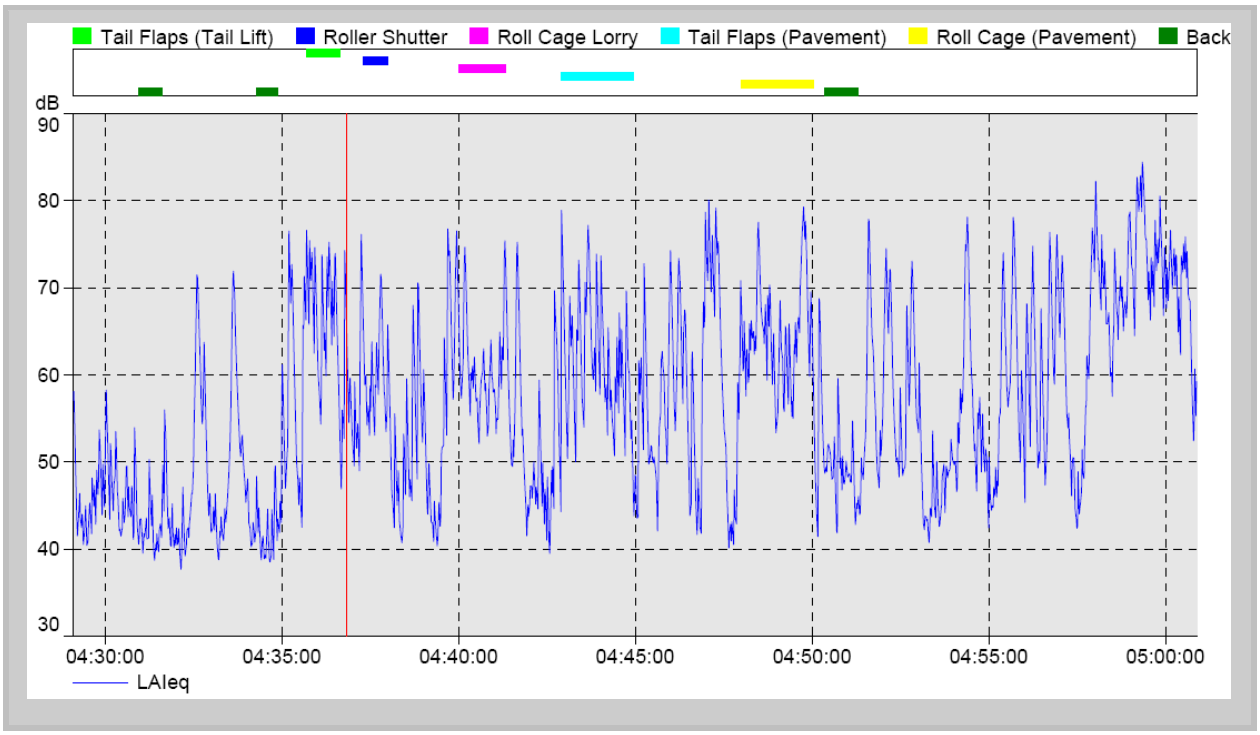
Searle (550 rpm) 2 Fan Condenser	Octave Band Centre Frequency (Hz)							Sum (A)	Units
	63	125	250	500	1000	2000	4000		
Sound Power Levels (L_w)	77.9	70.3	65.3	63.8	59.6	51.1	46.5	64.0	dB
Directivity (D_c)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	--	dB
Geometric Divergence (A_{div})	-37.1	-37.1	-37.1	-37.1	-37.1	-37.1	-37.1	--	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})	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	dB
Resultant Noise Levels (L_p)	46.8	39.2	34.2	32.7	28.5	20.0	15.4	33.9	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 CALCULATION OF DELIVERY NOISE LEVELS AT THE ASSESSMENT POSITION

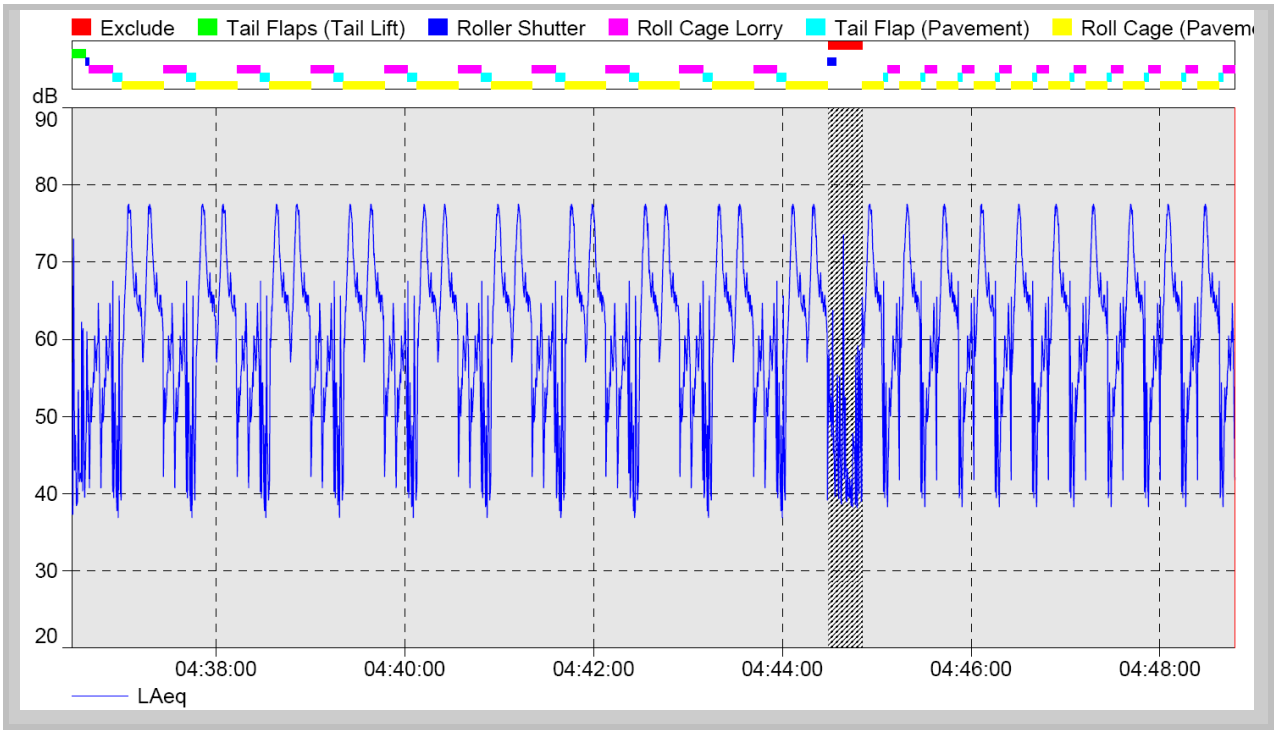
5.1 Description of Measurements



5.2 Resultant Noise Levels



5.3 Simulated Delivery Noise Results



The individual elements of the standard delivery were used to create a simulated delivery from a 40 foot standard articulated delivery lorry consists of a full delivery.

6 ASSESSMENTS

6.1 Plant Noise

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

4193

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 Sales Floor AC	06:00 to 23:00		On roof at rear of site.
Mitsubishi Heavy Sales Floor AC	06:00 to 23:00		On roof at rear of site.
Mitsubishi Heavy Cash Office AC	06:00 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	4.4m from the edge of the source to the assessment position.		
Item	Calculation	Clause	Commentary
Specific Noise Level $L_{Aeq,\ 1\ hour}$	44 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	44 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	-11 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	**-11 dB**		
Conclusion	**The assessment level is below 'Complaints Unlikely'**		
Test Laboratory:	4193		
Report Reference:	KR03427 / 01		
Test Date:	10th October 2013 – 11th October 2013		
Approval Date:	23rd April 2014		

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

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 Sales Floor AC	06:00 to 23:00		On roof at rear of site.
Mitsubishi Heavy Sales Floor AC	06:00 to 23:00		On roof at rear of site.
Mitsubishi Heavy Cash Office AC	06:00 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	4.4m from the edge of the source to the assessment position.		
Item	Calculation	Clause	Commentary
Specific Noise Level $L_{Aeq,5\ minutes}$	36 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	36 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	-9 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	**-9 dB**		
Conclusion	**The assessment level is below 'Marginal Significance'**		
Test Laboratory:	4193		
Report Reference:	KR03427 / 02		
Test Date:	10th October 2013 – 11th October 2013		
Approval Date:	23rd April 2014		

6.1.3 Early Morning (1 hour – 06:00 to 07:00)

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 Sales Floor AC	06:00 to 23:00		On roof at rear of site.
Mitsubishi Heavy Sales Floor AC	06:00 to 23:00		On roof at rear of site.
Mitsubishi Heavy Cash Office AC	06:00 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	4.4m from the edge of the source to the assessment position.		
Item	Calculation	Clause	Commentary
Specific Noise Level $L_{Aeq,5\ minutes}$	44 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	44 dB	8.3.	The acoustic feature correction is added to the specific noise level to obtain the rating level.
Background Noise Level	59 dB	7.1.	The background noise level was measured at an equivalent position.
Assessment Level	-14 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	**-14 dB**		
Conclusion	**The assessment level is below 'Complaints Unlikely'**		
Test Laboratory:	4193		
Report Reference:	KR03427 / 03		
Test Date:	10th October 2013 – 11th October 2013		
Approval Date:	23rd April 2014		

6.2 Delivery Noise Assessment

Delivery Noise Delivering the Goods **Department for Transport Guidance**		
Source	Operating Times	Source Position
12m Articulated Lorry	06:00 to 22:00 Monday to Sunday	½ hour delivery to side of store
Assessment Position	1m from the residential properties at the rear of the store	
Background Position	At the assessment position	
Distance	Delivery truck sweep to the assessment position (direct line of site)	
Item	Average	Commentary
Source Levels At Assessment Position	37 dB	Calculated from the indicative tests of delivery noise
Background Levels At Assessment Position	52 dB	Corrected using the noise map and background measurements
Assessment Level	-15 dB	Difference between source and existing noise levels. ($L_{Aeq} - L_{A90}$)
Conclusion	**There is unlikely to be a negative impact from deliveries**	
Test Laboratory:	4193	
Report Reference:	KR03427 / 03	
Test Date:	09:00 on 10th October 2013 to 07:00 on 11th October 2013	
Approval Date:	11th October 2013	

Notes: As there is no specific standard for assessing the impact of delivery noise on residential properties the assessment has followed the guidance within the Department for Transport document entitled *"Delivering the Goods"*. This indicates that the noise from deliveries should be assessed against the general background noise levels using a variety of different indexes. In this case the source levels have been assessed against the background noise levels measured as an LA90

7 CONCLUSIONS

7.1 Plant Noise

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.

7.2 Delivery Noise

The calculations indicate that deliveries can be undertaken between 06:00 and 22:00 hours 7 days per week without having a negative impact on the local residential properties. The site layout has been optimised to reduce the noise impact from delivery noise.

7.3 Opening Hours

There are noise related issues, other than those identified for the fixed plant and deliveries, that would indicate that opening the store between 06:00 and 23:00 hours would not have a detrimental effect on the local residents in terms of noise. The proposed store is located within a very busy area of Manchester with very high background noise levels.

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

8.1 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 Sales Floor AC	Sales Floor AC	Mitsubishi Heavy	FDC 100 VN
	Mitsubishi Heavy Sales Floor AC	Sales Floor AC	Mitsubishi Heavy	FDC 100 VN
	Mitsubishi Heavy Cash Office AC	Cash Office AC	Mitsubishi Heavy	SRK 25 ZG
	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
2)	Mitsubishi Heavy Sales Floor AC	On roof at rear of site.	07:00 to 23:00	Continuously On Demand
3)	Mitsubishi Heavy Sales Floor AC	On roof at rear of site.	07:00 to 23:00	Continuously On Demand
4)	Mitsubishi Heavy Cash Office AC	On roof at rear of site.	07:00 to 23:00	Continuously On Demand
	Description of Premises	Site based on busy main road on large commecial street. Residential Apartments located above Large, primarily commercial area on busy main road		

8.2 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	Local traffic noise from the city centre.

8.3 C) Relative Positions

1)	**Assessment Position**	Residential flat overlooking the plant area		
		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 Lamp post 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 4m from the proposed assessment position.		

8.4 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

8.5 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.

8.6 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

8.7 G) Date and Time of Measurements

1)	Source Measurements	14th May 2012
	Background Measurements	09:00 on 10th October 2013 to 07:00 on 11th October 2013

8.8 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	$L_{Aeq,\ 1\ hour}$ 55 dB	$L_{Aeq,5\ minutes}$ 34 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

8.9 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

8.1 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

8.2 K) Rating Levels

1)	Specific Noise Level	Day Time	Night Time
		(07:00 – 23:00)	(23:00 to 07:00)
		$L_{Aeq,1\ hour}$ 44 dB	$L_{Aeq,5\ min}$ 36 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	$L_{Aeq,1\ hour}$ 44 dB	$L_{Aeq,5\ min}$ 36 dB

8.3 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	

8.4 M) Excess of Rating over Background Level

1)	Assessment	Day Time	Night Time
		(07:00 – 23:00)	(23:00 to 07:00)
		-11 dB	-9 dB
2)	Conclusion	below 'Complaints Unlikely'	below 'Marginal Significance'

9 APPENDIX B – SITE LAYOUT / PHOTOGRAPHS

9.1 Site Location



Proposed Source Location:	Latitude:	53.481356°	Longitude:	-2.248126°	Elevation:	0.0m



Front of site.



Side of site

9.2 Assessment Position



ssessment position 1:	Latitude:	53.481287°	Longitude:	-2.248062°	Elevation:	12.0m



Assessment position

9.3 Background Measurement Position



Background Measurement:	Latitude:	53.480835°	Longitude:	-2.248365°	Elevation:	4m



Lamp post on Bridge Street

9.4 Supplied Drawings



10 APPENDIX C - BACKGROUND NOISE LEVELS

10.1 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	91.4	72.6	74.9	92.9	71.8	74.3	62.9	74.52	78.1	59.6
08:00 – 09:00	64.9	74.3	75.2	60.2	72.8	74.3	63.7			
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}										

10.2 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 x 10^{-5} Nm^{-2}							

11 APPENDIX D – SOUND POWER LEVELS

11.1 Day Time (07:00 – 23:00)

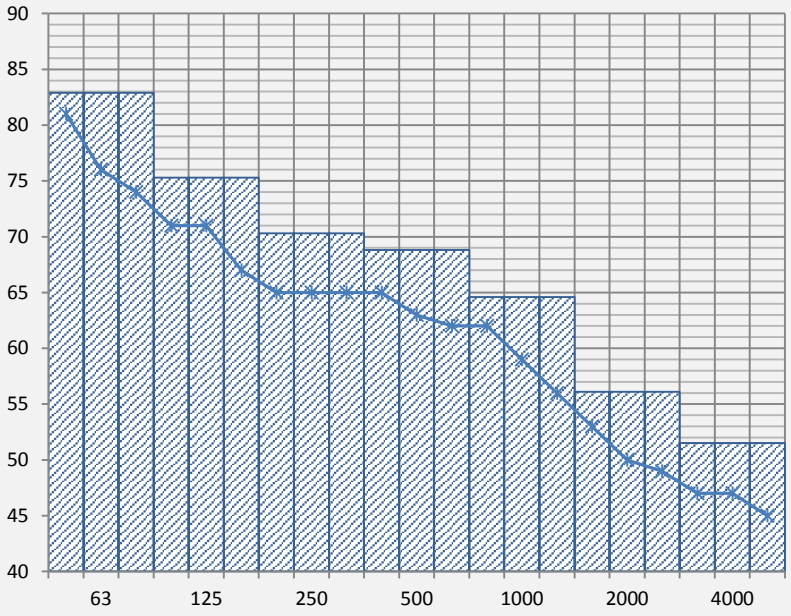
11.1.1 Searle (550 rpm) 2 Fan Condenser

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	

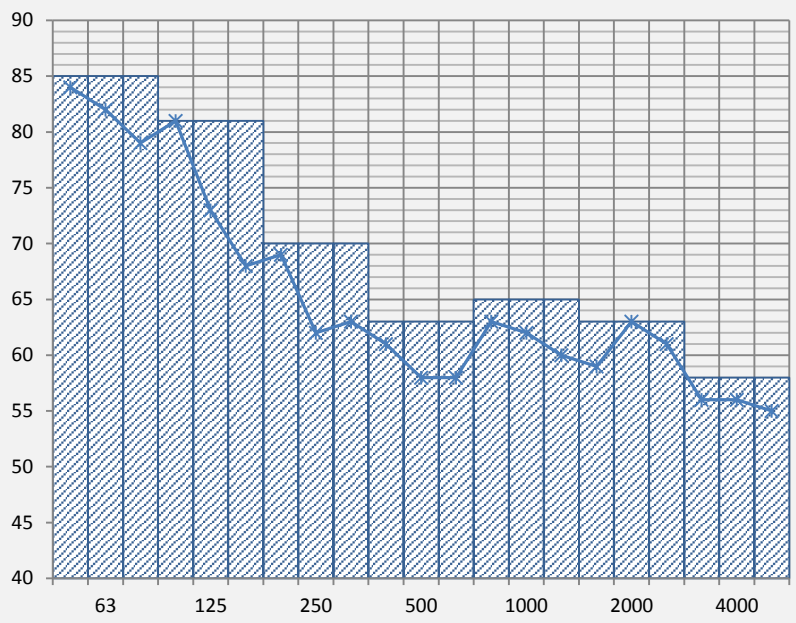
11.1.2 Mitsubishi Heavy Sales Floor AC

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	FDC 100 VN	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	84
63	82
80	79
100	81
125	73
160	68
200	69
250	62
315	63
400	61
500	58
630	58
800	63
1000	62
1250	60
1600	59
2000	63
2500	61
3150	56
4000	56
5000	55



Octave Band Centre Frequency (Hz)						
63	125	250	500	1000	2000	4000
85	81	70	63	65	63	58

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

$L_{W(A)}$	**71 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	

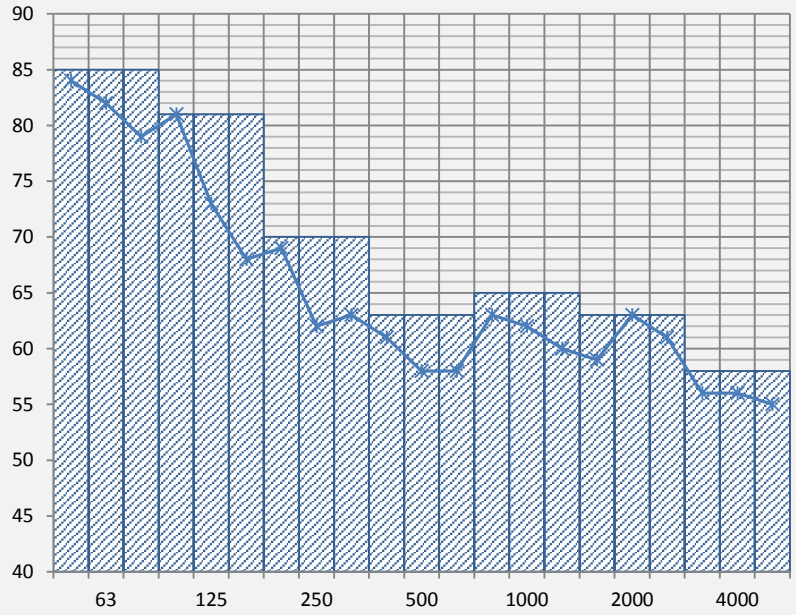
11.1.3 Mitsubishi Heavy Sales Floor AC

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	FDC 100 VN	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	84
63	82
80	79
100	81
125	73
160	68
200	69
250	62
315	63
400	61
500	58
630	58
800	63
1000	62
1250	60
1600	59
2000	63
2500	61
3150	56
4000	56
5000	55



Octave Band Centre Frequency (Hz)

63	125	250	500	1000	2000	4000
85	81	70	63	65	63	58

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

$L_{w(A)}$	**71 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 / 05	
Test Date:	14th May 2012	
Approval Date:	20th May 2012	

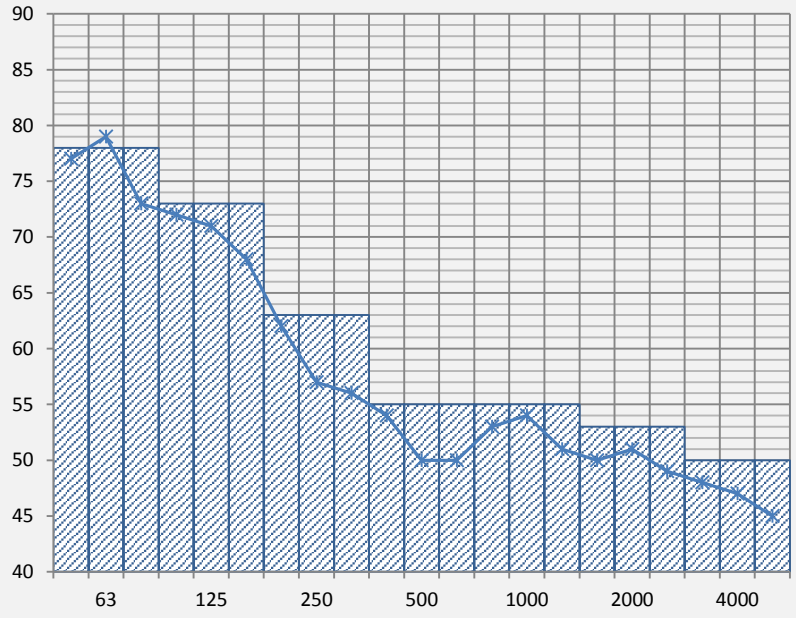
11.1.4 Mitsubishi Heavy Cash Office AC

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	SRK 25 ZG	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	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)

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

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

$L_{w(A)}$	**63 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 / 06	
Test Date:	14th May 2012	
Approval Date:	20th May 2012	

11.2 Night Time (23:00 – 07:00)

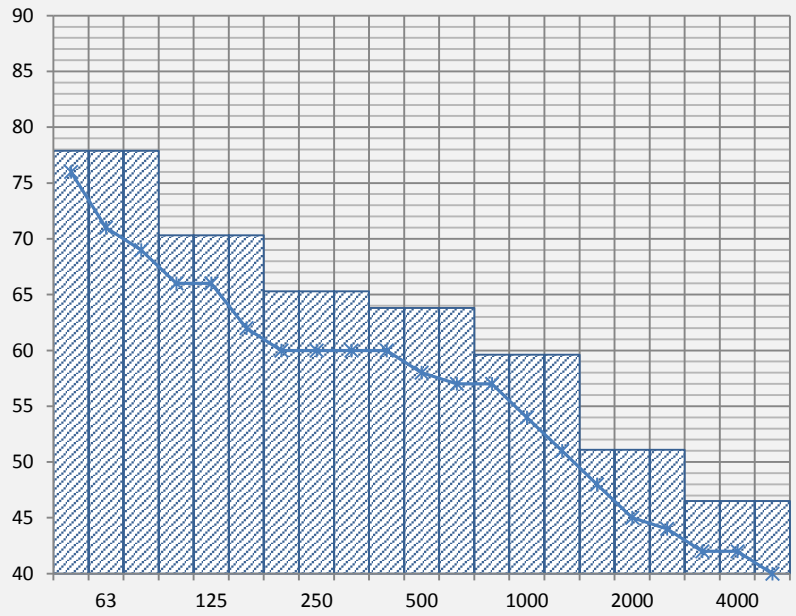
11.2.1 Searle (550 rpm) 2 Fan Condenser

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	

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

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