FL010050

Cricklewood Co-Operative

22 - 26 Cricklewood, Cricklewood
Brondesbury,
London. NW2 3HD.

Noise Impact Assessment
British Standard 4142: 2014

January 2016

flumpit Ltd

Flumpit

56 Bassett Green Road,
Southampton.
Hampshire. SO16 3DX

+44 (0) 2380 550455

Version Control

Version Number:	FL010050 v1.2 (Full)	Date:	28th January 2016
Details:	Initial issue for client comments		
Version Number:		Date:	
Details:			

Authorisation

Report Prepared By:	R Scrivener	Date:	28th January 2016
Report Checked By:	--	Date:	--
Report Approved By:	R Scrivener	Date:	28th January 2016

Table of Contents

1. EXECUTIVE SUMMARY

1.1. Instruction

Flumpit Ltd have been instructed by BJA Consulting Refrigeration Engineers Ltd of Bridge Mills, Huddersfield Road, Holmfirth to undertake an environmental noise survey at the proposed Co-Operative Store at 22 - 26 Cricklewood, Cricklewood, Brondesbury, London to support the planning application for the proposed refrigeration and air conditioning equipment.

1.2. Scope of Report

British Standard 4142: 2014 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

1.3.1 British Standard 4142:1997

British Standard 4142:1997	Day Time (07:00 – 23:00)	Night Time (23:00 – 07:00)
Rating Noise Levels	$L_{Aeq,1\ hours}$ 47 dB	$L_{Aeq,5\ minutes}$ 34 dB
Background Noise Levels	$L_{A90,16\ hours}$ 49 dB	$L_{A90,8\ hours}$ 35 dB
Assessment	-2	-1
Likelihood of Complaints	Low Impact	Low Impact

1.4. Conclusions

1.4.1 Impact on Local Amenity

The proposed refrigeration and air conditioning equipment to support the development of the Co-Operative store will not have a demonstrable and significant impact on local residential amenity in terms of noise and therefore it would be recommended that planning permission is granted.

1.4.2 Audibility

It is very likely that due to the design, layout and acoustic control measures included within the proposal the proposed refrigeration and air conditioning units will not be audible at the nearest noise sensitive residential properties.

2. TEST PROCEDURE

2.1. Scope of Report

This report sets out to determine if the installation of the Green and Cool 2 Fan Gas Cooler and managers office AC Unit 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. ISO 1996 – Part 2:2007

2.2.1 Scope of ISO 1996 – Part 2:2007

Part 2 of ISO 1996 describes the determination and assessment of environmental noise levels through either direct measurement, b extrapolation of measurement results, or by means of calculation.

2.2.2 Measurement Time Interval

The selection of the measurement time interval has been chosen in accordance to this standard. The measurements have been taken over a continuous period and includes both the day and night time period.

2.2.3 Instrumentation

The instrumentation and all components associated with the instrument used to measure the sound levels comply with the instrumentation system given in section 5.1 of this standard.

2.2.4 Calculation Methods

Although there are no internationally recognised calculation methods other national standards have been used for this assessment.

2.3. British Standard 4142:2014

2.3.1 Scope of British Standard 4142:2014

In the assessment of the proposed plant, consideration has been given to the scope of British Standard 4142:2014, which in section 1, details applicability of this standard to rating assessing sound of an industrial and/or commercial nature.

> *"The determination of noise amount to a nuisance is beyond the scope of this British Standard.*
>
> *The standard is not intended to be applied to the derivation of indoor sound levels arising from sound levels outside, or the assessment of indoor sound levels."*

It is considered appropriate that both the background noise levels and the rating noise levels obtained fall within the scope of British Standard 4142:2014 by using outdoor sound levels to assess the effect of sound on local residents.

2.4. Specific Noise Levels

2.4.1 Assessment Position

The assessment position was established as the residential properties at the rear and overlooking the plant area located around 4.9m from the proposed refrigeration and air conditioning sources within the dedicated plant area.

2.4.2 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.

2.4.3 Calculations

The specific noise levels are calculated at the assessment position located at the residential properties surrounding the plant area using the calculations detailed within ISO 9613 Part 1 and 2: 1996. These calculations take the manufacturers sound power levels into 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.

2.5. Background Noise Levels

2.5.1 Assessment Position

In line with the requirements of British Standard 4142:1997 the background noise levels should be measured at the assessment position.

2.5.2 Equivalent Position

The background noise levels were measured at the equivalent position located on at the rear of the site between 22:00 on 22nd February 2015 and 02:00 on 23rd February 2015.

2.6. Rating Levels (Character Correction)

It is appropriate to add a character correction where there is a new source that cannot be measured in line with BS4142:2014. There are 3 methods for approaching this.

a) Subjective method
b) Objective method (for tonality)
c) Reference method

2.6.1 Subjective Method

The subjective method establishes a rating penalty that is added to the specific noise level if any of the following is present at the assessment position.

If a tone is expected to be present a character correction of 0 dB to 6 dB is added depending on how perceptible it is at noise sensitive locations.

BS4142:2014 – Section 9.2 Subjective Method	Perceptibility to noise sensitive facades	Correction
Tonality Ranging from not tonal to prominently tonal	Not tonal	+0
	Just perceptible	+2
	Clearly perceptible	+4
	Highly perceptible	+6

If the source is expected to be impulsive a character correction of 0 dB to 9 dB is added depending on how perceptible it is at noise sensitive locations.

BS4142:2014 – Section 9.2 Subjective Method	Perceptibility to noise sensitive facades	Correction
Impulsivity Considering both the rapidity and any overall change in sound levels	Not impulisve	+0
	Just perceptible	+3
	Clearly perceptible	+6
	Highly perceptible	+9

When the sound features are neither tonal nor impulsive, a character correction of +3 is added for the readily distinctive quality against the acoustic environment or for the intermittency of the source.

BS4142:2014 – Section 9.2 Subjective Method	Perceptibility to noise sensitive facades	Correction
Readily Distinctive	Is not present	+0
	Is present	+3
Intermittency	Is not present	+0
	Is present	+3

2.6.2 Objective Method

The objective method is used if the subjective method is not sufficient. This identifies tones from the one-third octave bands and adds a character correction of 6 dB if the tone is present.

According to BS4142:2014 (Annex C):

> *"For a prominent, discrete tone to be identified as present, the time-averaged sound pressure level in the one-third octave band of interest is required to exceed the time-averaged sound pressure levels of both adjacent one-third octave bands b some constant level difference."*

BS4142:2014 – Section 9.3 Objective Method	One – Third Octave Band	Difference
The level differences between adjacent one-third octave bands that identify a tone	25 Hz to 125 Hz	15 dB
	160 Hz to 400 Hz	8 dB
	500 Hz to 10,000 Hz	5 dB

2.6.3 Reference Method

The reference method is used if using one-third octave bands is not sufficient. This provides a method for assessing how audible a tone will be or how prominent the impulsive sounds will be and produces a penalty of up to 6 dB.

3. CRITERIA

3.1. BS142:2014

British Standard 4142:2014 outlines a general consideration and 3 levels of impact based on the calculated assessment level:

> *"Typically, the greater [the] difference, the greater the magnitude of the impact.*
>
> *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
>
> *A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.*
>
> *Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."*

The following is noted in BS4142:2014:

> *"Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."*

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		
Green and Cool Gas Cooler	73.9	66.3	61.3	59.8	55.6	47.1	42.5	60.0	dB
Daikin Single AC Unit	75.0	71.0	60.0	53.0	55.0	53.0	48.0	61.1	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		
Green and Cool Gas Cooler	65.9	58.3	53.3	51.8	47.6	39.1	34.5	52.0	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
$A_{bar} = 10 . Log_{10} [3 + (40 . \delta / \lambda) - A_g]$ *Note 1 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 - (Green and Cool Gas Cooler)

Green and Cool Gas Cooler	Octave Band Centre Frequency (Hz)							Sum (A)	Units
	63	125	250	500	1000	2000	4000		
Sound Power Levels (L_w)	73.9	66.3	61.3	59.8	55.6	47.1	42.5	60.0	dB
Directivity (D_c)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	--	dB
Geometric Divergence (A_{div})	-24.8	-24.8	-24.8	-24.8	-24.8	-24.8	-24.8	--	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)	55.1	47.5	42.5	41.0	36.8	28.3	23.7	42	dB

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

4.3.2 Source 2 – (Daikin Single AC Unit)

Daikin Single AC Unit	Octave Band Centre Frequency (Hz)							Sum (A)	Units
	63	125	250	500	1000	2000	4000		
Sound Power Levels (L_w)	75.0	71.0	60.0	53.0	55.0	53.0	48.0	61.1	dB
Directivity (D_c)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	--	dB
Geometric Divergence (A_{div})	-24.8	-24.8	-24.8	-24.8	-24.8	-24.8	-24.8	--	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)	56.2	52.2	41.2	34.2	36.2	34.2	29.2	42	dB

L_w - Sound Power Levels, L_w. BS EN ISO 13487:2003. Reference 1 x 10-12 watts. L_p - 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 – (Green and Cool Gas Cooler)

Green and Cool Gas Cooler	Octave Band Centre Frequency (Hz)							Sum (A)	Units
	63	125	250	500	1000	2000	4000		
Sound Power Levels (L_w)	65.9	58.3	53.3	51.8	47.6	39.1	34.5	52.0	dB
Directivity (D_c)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	--	dB
Geometric Divergence (A_{div})	-24.8	-24.8	-24.8	-24.8	-24.8	-24.8	-24.8	--	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)	47.1	39.5	34.5	33.0	28.8	20.3	15.7	34.2	dB

L_w - Sound Power Levels, L_w. BS EN ISO 13487:2003. Reference 1 x 10-12 watts. L_p - Sound Pressure Levels. Reference 2 x 10^{-5} 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
Green and Cool Gas Cooler	24 hours per day		Dedicated plant area at the rear of the store
Daikin Single AC Unit	07:00 to 23:00		
Assessment Position	Residential properties over-looking the plant area at the rear		
Background Position	At the side of the store within Rondu Road		
Distance	4.9m from the edge of the source to the assessment position.		
Item	Calculation	Clause	Commentary
Specific Noise Level $L_{Aeq,\ 1\ hour}$	47 dB	7.3.	Specific noise level was calculated from measurements made at 1m ISO 9613:1996[3].
Tonality Feature Correction	+ 0 dB	9.2.	Reference section 9.2 of BS4142:2014 Subjective Assessment.
Impulsivity Feature Correction	+ 0 dB	9.2.	Reference section 9.2 of BS4142:2014 Subjective Assessment.
Other Feature Correction	+0 dB	9.2.	Reference section 9.2 of BS4142:2014 Subjective Assessment.
Rating Noise Level $L_{Aeq,\ 1\ hour}$	47 dB	9.2.	The acoustic feature correction is added to the specific noise level to obtain the rating level.
Background Noise Level $L_{A90,\ 1\ hour\ (Modal)}$	49 dB	8.	The background noise level was measured at an equivalent position.
Assessment Level	-2 dB	11.	The background level is subtracted from the rating level. (Numerical values)
Conclusion BS 4142:1997[1]	Significant Adverse Impact – Assessment of around +10 dB Adverse Impact – Assessment of around +5 dB Low Adverse Impact – Assessment of around 0 or less		
Assessment	**-2 dB**		
Conclusion	**The assessment level is Below "Low Impact"**		
Report Reference:	FL010050 / 01		
Test Date:	22:00 on 22/02/2015 to 02:00 on 23/02/2015		
Approval Date:	10/05/2015		

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

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
Green and Cool Gas Cooler	24 hours per day		Dedicated plant area at the rear of the store
Assessment Position	Residential properties over-looking the plant area at the rear		
Background Position	At the side of the store within Rondu Road		
Distance	4.9m from the edge of the source to the assessment position.		
Item	Calculation	Clause	Commentary
Specific Noise Level $L_{Aeq,\ 1\ hour}$	34 dB	7.3.	Specific noise level was calculated from measurements made at 1m ISO 9613:1996[3].
Tonality Feature Correction	+ 0 dB	9.2.	Reference section 9.2 of BS4142:2014 Subjective Assessment.
Impulsivity Feature Correction	+3 dB	9.2.	Reference section 9.2 of BS4142:2014 Subjective Assessment.
Other Feature Correction	+0 dB	9.2.	Reference section 9.2 of BS4142:2014 Subjective Assessment.
Rating Noise Level $L_{Aeq,\ 1\ hour}$	34 dB	9.2.	The acoustic feature correction is added to the specific noise level to obtain the rating level.
Background Noise Level $L_{A90,\ 1\ hour\ (Modal)}$	35 dB	8.	The background noise level was measured at an equivalent position.
Assessment Level	-1 dB	11.	The background level is subtracted from the rating level. (Numerical values)
Conclusion BS 4142:1997[1]	Significant Adverse Impact – Assessment of around +10 dB Adverse Impact – Assessment of around +5 dB Low Adverse Impact – Assessment of around 0 or less		
Assessment	**-1 dB**		
Conclusion	**The assessment level is Below "Low Impact"**		
Report Reference:	FL010050 / 02		
Test Date:	22:00 on 22/02/2015 to 02:00 on 23/02/2015		
Approval Date:	10/05/2015		

6. CONCLUSIONS

6.1. Impact on Local Amenity

The proposed refrigeration and air conditioning equipment to support the development of the Co-Operative store will not have a demonstrable and significant impact on local residential amenity in terms of noise and therefore it would be recommended that planning permission is granted.

6.2. Audibility

It is very likely that due to the design, layout and acoustic control measures included within the proposal the proposed refrigeration and air conditioning units will not be audible at the nearest noise sensitive residential properties.

7. APPENDIX A - SITE LAYOUT

7.1. Key Locations

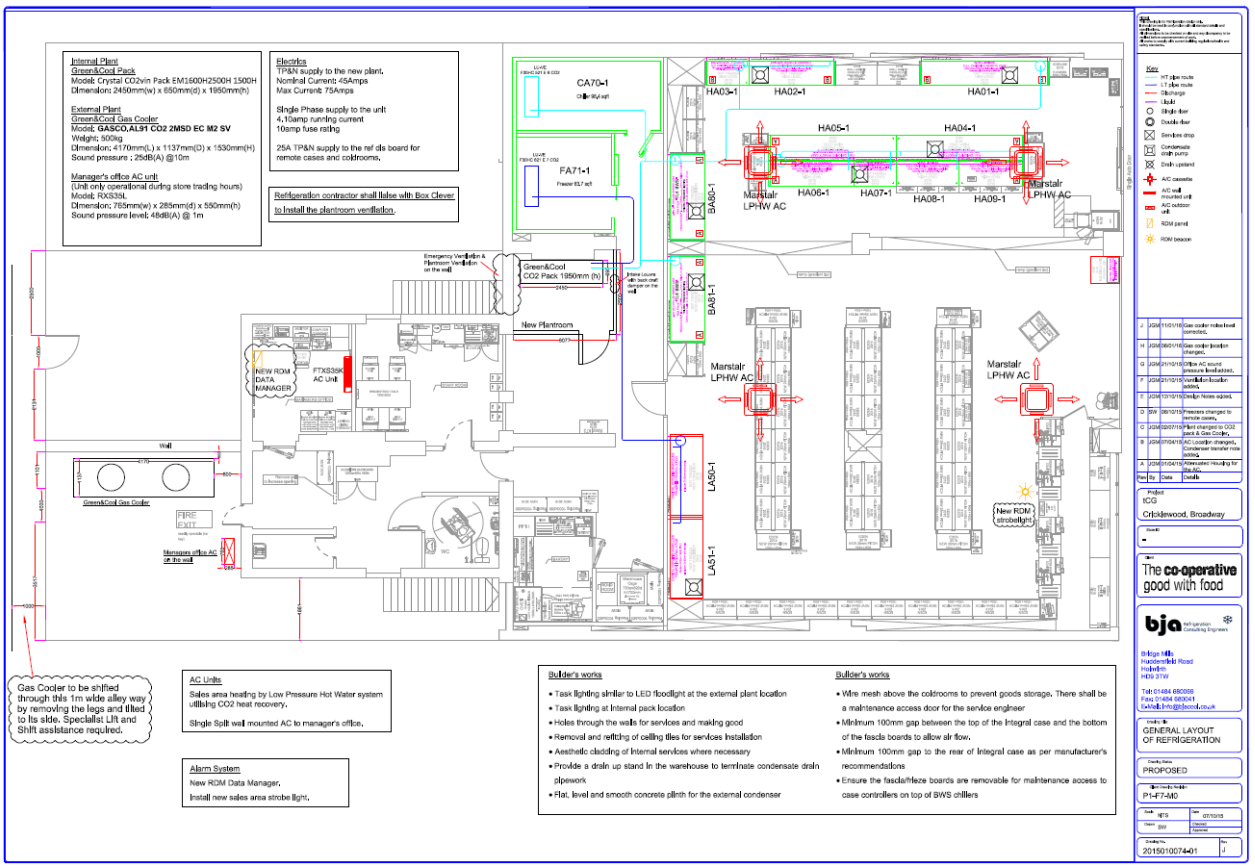
Plant Area	51.553186	-0.210489	At the rear of the site in a dedicated plant area
Assessment Position	51.553163	-0.210531	Residential Properties at the rear of the store
Background Position	51.553485	-0.210440	At the side of the store within Rondu Road

7.2. Key Photographs

View on Front of Store

Side of Building – Louvres at high level on Ground Floor

7.3. BJA Drawings

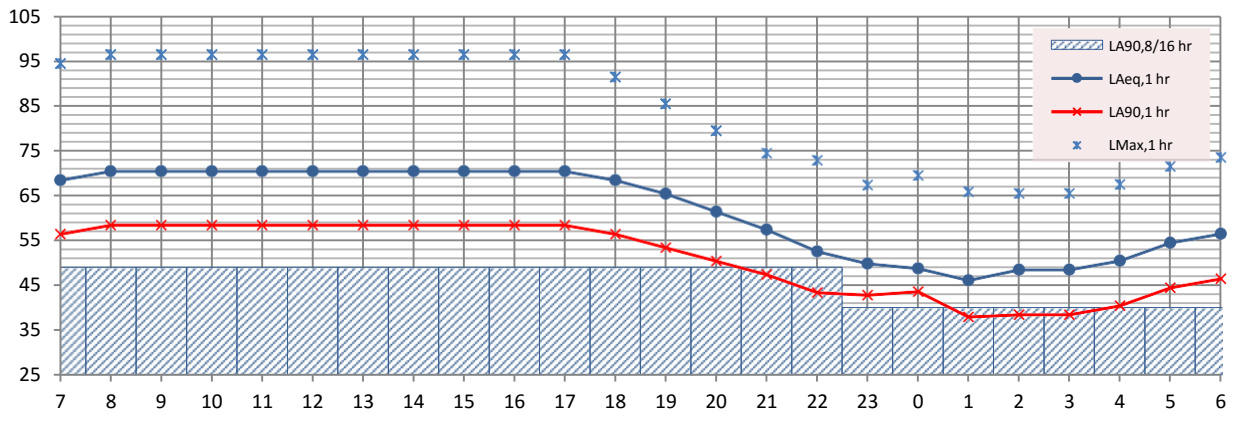


8. Background Noise Levels

8.1. 22:00 on Saturday 22nd February 2015 to 02:00 on Sunday 23rd February 2015

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	94	64	66	54	68	74	56	68	73	49
08:00 – 09:00	96	66	68	56	70	76	58			
09:00 – 10:00	96	66	68	56	70	76	58			
10:00 – 11:00	96	66	68	56	70	76	58			
11:00 – 12:00	96	66	68	56	70	76	58			
12:00 – 13:00	96	66	68	56	70	76	58			
13:00 – 14:00	96	66	68	56	70	76	58			
14:00 – 15:00	96	66	68	56	70	76	58			
15:00 – 16:00	96	66	68	56	70	76	58			
16:00 – 17:00	96	66	68	56	70	76	58			
17:00 – 18:00	96	66	68	56	70	76	58			
18:00 – 19:00	91	64	66	54	68	74	56			
19:00 – 20:00	85	61	63	51	65	71	53			
20:00 – 21:00	79	57	59	47	61	65	50			
21:00 – 22:00	74	54	56	43	57	59	47			
22:00 – 23:00	**72.9**	**50.6**	**52.0**	**40.0**	**52.6**	**55.9**	**43.5**			
23:00 – 00:00	**67.4**	**47.3**	**49.3**	**42.1**	**49.9**	**54.3**	**42.9**	51	56	40
00:00 – 01:00	**69.5**	**46.5**	**48.2**	**40.6**	**48.8**	**49.3**	**43.6**			
01:00 – 02:00	**65.9**	**45.2**	**49.7**	**40.0**	**46.2**	**47.7**	**38.0**			
02:00 – 03:00	66	46	48	35	49	51	39			
03:00 – 04:00	66	46	48	35	49	51	39			
04:00 – 05:00	68	48	50	37	51	53	41			
05:00 – 06:00	72	52	54	41	55	57	45			
06:00 – 07:00	74	54	56	43	57	59	47			

Sound Pressure Levels, dB. Reference level of 2×10^{-5} Nm^{-2}



END OF REPORT

9. REFERENCES

9.1. British Standard 4142: 1997

Rating industrial noise affecting mixed residential and industrial areas.

9.2. British Standard 13487: 2003

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

9.3. 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.

9.4. International Standard Organisation 9613 – Part 2: 1996

Acoustics – Attenuation of sound during propagation outdoors.

9.5. World Health Organisation Guidelines for Community Noise: 1999

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

9.6. World Health Organisation Europe Night Noise Guidelines 2009

end of report