



AIRTIGHT & NOISECHECK LIMITED

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BS4142 ACOUSTIC TESTING REPORT FOR

CRITCHLEY CONSULTANTS
THE OLD BREWERY
15E SOUTH STREET
HAVANT
HAMPSHIRE
PO9 1BU

SITE ADDRESS

25 SOUTH STREET
EMSWORTH
HAMPSHIRE
PO10 7EG

A handwritten signature in grey ink, appearing to read "Michael Vine", positioned above a horizontal line.

Acoustic Engineer:

Michael Vine

Date: 14-15th Jan 2016

AIRTIGHT & NOISECHECK BUILDING ACOUSTIC TESTING

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Raw data is available upon request

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Customer Name:

Date: 14-15th Jan 2016

Critchley Consultants
The Old Brewery
15E South Street
Havant
Hampshire
PO9 1BU

Site Address:

25 South Street
Emsworth
Hampshire
PO10 7EG

Acoustic Engineer:

Mr. Michael Vine

Equipment used:

Nor121 Environmental Analyser – Serial No 31375, Calibration due February 2016.

Analyser complies with the following standards:

IEC 60651 type 1
IEC 60804 type 1
IEC 61260 class 1
IEC 225
ANSI S1.4 – 1985 type 1
ANSI S1.43 – 1997 type 1
ANSI S1.11 – 1986 order 3 type 1D
Norsonic production standard set for the Nor121

Measurement Microphone (Nor 1225) - serial No 72933, Cal due April 2017

Acoustic Calibrator Nor 1251 – Serial No 31652, Cal due August 2016

Measurement Procedure:

The external evening & night time existing noise levels were measured at the nearest residential façade for a 15hour period between Thursday 14th & Friday 15th December 2015 in order to ascertain if the installation of 7 x external condenser units to be installed at a building façade at ground & 1st floor level will have an adverse impact on the residential dwellings located in the vicinity. The noise levels were recorded for a 15hour period as the plant will be running for 24hours a day (low level at night time) and this time period encapsulated the noise sensitive period. This report will use the criteria set out in BS4142: 2014 for the assessment method.

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Executive Summary:

Airtight & Noisecheck Ltd were instructed by Critchley Consultants to undertake a BS4142: 2014 noise impact assessment (NIA) at one microphone location in order to establish if the installation of 7 x external condenser units to a building façade of a newly converted restaurant will have an adverse impact on the residential dwellings in close proximity to the site. The measurement location was:

- Rear of building – At residential facade

This report is concerned with the proposed noise levels of the 7 x new external condensers in relation to the background noise levels in the location listed above, calculations will be used to establish if the plant will have an adverse impact on the residents of the dwellings.

It must be noted that there are many existing condenser units located in the same location as the proposed units as the immediate area is a common area shared by two commercial buildings. However the existing plant associated with the other building were not in operation during the measurement procedure. The noise data for the condensers has been supplied by the installers directly as they are not yet installed.

The results in this report were measured against criteria set out in British Standard BS4142: 2014 Methods for Rating and assessing industrial and commercial sound. This document states:

- 1- A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- 2- A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.
- 3- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific source will have an adverse impact or a significant adverse impact. 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 measured results and calculations performed indicate that further mitigation measures will be required to ensure that the rating level of the plant is below the LA90 values and also achieve the NOEL (No Observed Effect Level) for the site (as per the local authority). The level of mitigation is required within this report and is based on all 8 condensers being in use during opening hours of the restaurant and just 1 unit being in use throughout the night time period.

It is understood that the plant will be on continuously throughout the daytime and evening period, and intermittently throughout the night time period. It will also be running on 'silent mode' throughout the night time period.

All calculations are based on the residential dwelling located 3metres to the South of the 7 x wall mounted units.

It may be apparent that due to the potential impact during the daytime period that mitigation measures are implemented throughout the night time period to ensure sleep is not disturbed.

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1 **Objective:**

1.1 To determine if the proposed installation of 7 x external condenser units will have an adverse impact on the residential dwellings located in the area.

The report will work towards the requirements of BS4142: 2014, with reference made to the No Observed Effect Level (NOEL) as requested by the local authority. NOEL is defined as:

‘This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.’

This is referenced in many documents such as NPSE & WHO – Night noise guidelines for Europe. In this case it is fair to say that the existing LA90 value (background noise) would represent the NOEL noise level for this site.

2 **Calibration:**

2.1 The microphone was calibrated before and after the testing procedure and no drift was recorded on the microphone.

3 **Site Layout & Microphone Position:**

3.1 25 South Street is set immediately to the West of South Street with public houses located immediately to the North & South. There is a large car park located to the West of the site and residential dwellings to the East of South Street.

3.2 The building is being renovated to incorporate a new bar/restaurant within the building and the plant is to control the air conditioning within the building throughout the day & night time period. The new plant is to be mounted to the wall on the Southern façade of the new extension (7 x condensers). The 7 x condensers will be facing the building located to the South.

3.3 The existing commercial units apparent in this location all have plant associated with them and the proposed plant will be located in the same area as the plant for the Bluebell public House, which is located immediately to the South.

3.4 The existing building has been extended to the rear to accommodate a dining area and kitchen. There is a proposal to further develop the section of building to the North of the dining room at a later stage. The majority of residential dwellings are located to the West of the site beyond the car park, but there is an existing residential dwellings located above the Bluebell Public House immediately to the South. This dwelling will be 3metres from the 6x condensers.

3.5 The microphone was located at the rear of the building, at the residential façade. It was in excess of 3.5m from the façade and also in excess of 4m from the ground. It offered a fair reflection of the background noise levels apparent for the residential dwelling.

The plant associated with the existing building to the South is:

- Kitchen extraction system and associated AC Units

This system is in operation during opening hours of the public house. The proposed plant will be in operation during opening hours with one unit working on silent mode throughout the night time period to maintain temperature within the building. It is unclear as to the number of units that will be running throughout the day time as this may vary. But this report has assumed worst case scenario, and that is that all 8 will be running continuously.

3.6 The plant that is being installed is:

- 2 x Daikin 4MX80E external condenser units, 1 x Daikin 4MX90E, 2 x Daikin RSG50L & 2 x Daikin RZQSG100 units.

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Unit	Mode	Sound Pressure Level
4MX80E	Cooling	48dBA
	Heating	49dBA
	Night time – Silent Mode	44dBA
4MX90E	Cooling	52dBA
	Heating	52dBA
RXG50L	Cooling	48dBA
	Heating	48dBA
RZQSG100	Cooling	53dBA
	Heating	57dBA
Combined	Cooling	59dBA
	Heating	62dBA

4 Weather Conditions:

4.1 The weather was dry for the duration of testing, approximately 10degrees Celsius, there was no wind or rain during the measurement procedure.

5 Hours of Operation:

5.1 The proposed hours of operation for the plant at max level will match the restaurant opening hours which are 0830-2300 Monday to Thursday & Sunday and 0830-0000 on Friday & Saturday, however only 1 unit will run during the night time period so the levels will be less, also it has been illustrated that a sound pressure level of 44dBA is apparent for this type of unit during the night (4MX80E).

6 Results: Background Noise Levels – Day Time:

Measurement Location	LAeq Value 1hour	Lowest LA90 1hour
Residential Boundary – 1 st floor dwelling to South	46dB(A)	41dB(A)

Evening & Night Time:

Measurement Location	LAeq Value 15min	Lowest LA90 15min
Evening (2300-0000) Residential Boundary – 1 st floor dwelling to South	43dB(A)	39dB(A)
Night time (0000-0700) – 1 st floor dwelling to South	37dB(A)	34dB(A)

(Results obtained using the environmental sound level meter and where needed taking a logarithmic average of different values)

6.1 The L_{A90} values listed above are the target values for the residential dwelling boundary. The rating tables are listed below for each time period.

6.2 The table listed below shows the applied corrections for varying acoustic features, these apply to the receptor location and not the source location.

Activity	Combined Sound Pressure Level at 1m	Specific Level
7 x wall mounted Condensers	59dBA for Cooling	59dB
	62dBA for Heating	62dBA

6.3 The new units are understood to be in operation continuously as they will be heating or cooling the building, acoustic feature corrections such as tonality & distance propagation will be applied to the rating levels in the results tables

6.4 The following tables will show the rating level for the 7 x new condensers compared to the background noise levels at the residential façade. The results will be compared to day time, evening time & night time noise levels.

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6.5 Day Time Results Table:

7 x wall mounted units – Cooling

<i>Results</i>		<i>Commentary</i>
Combined Ambient Sound Level	Sound Pressure Level = 59dB L _p – Cooling	Taken from manufacturer & combined level using decibel addition Total for 7 units
Residual Sound Level	46dBA Taken at evening time	Measured at receptor
Combined Specific Sound Level	59dB	$L_s = 10\log(10L^{9/10} - 10L^{7/10})$
Acoustic Feature Correction	+2 for tonality +3dB for Directivity (D) 64dB – Overall level	Tone present Junction of 1 plane (Q=2) - facade
Reductions due to distance, barrier & conversion to Sound Pressure Level	-10dB -10dB – Total reduction	$L_2 = L_1 - 20\log(r_2/r_1)$ 3m
Rating Level	54dBA – at facade	
Background Sound level	41dBA L _{A90 1hour}	Measured at receptor
Excess of rating over background	(54-41) = +13dB – Cooling	
Assessment indicates adverse impact at receptor		The installation of plant will have an adverse impact at the receptor location

7 x wall mounted units – Heating

<i>Results</i>		<i>Commentary</i>
Combined Ambient Sound Level	Sound Pressure Level = 62dB L _p – Cooling	Taken from manufacturer & combined level using decibel addition Total for 7 units
Residual Sound Level	46dBA Taken at evening time	Measured at receptor
Combined Specific Sound Level	62dB	$L_s = 10\log(10L^{9/10} - 10L^{7/10})$
Acoustic Feature Correction	+2 for tonality +3dB for Directivity (D) 67dB – Overall level	Tone present Junction of 1 plane (Q=2) - facade
Reductions due to distance, barrier & conversion to Sound Pressure Level	-10dB -10dB – Total reduction	$L_2 = L_1 - 20\log(r_2/r_1)$ 3m
Rating Level	57dBA – at facade	
Background Sound level	41dBA L _{A90 1hour}	Measured at receptor
Excess of rating over background	(57-41) = +16dB – Cooling	
Assessment indicates adverse impact at receptor		The installation of plant will have an adverse impact at the receptor location

6.6 Night Time Results Table – 2300-000hrs:

7 x wall mounted units – Cooling

<i>Results</i>		<i>Commentary</i>
Combined Ambient Sound Level	Sound Pressure Level = 59dB L _p – Cooling	Taken from manufacturer & combined level using decibel addition Total for 7 units
Residual Sound Level	43dBA Taken at evening time	Measured at receptor
Combined Specific Sound Level	59dB	$L_s = 10\log(10L^{9/10} - 10L^{7/10})$
Acoustic Feature Correction	+2 for tonality +3dB for Directivity (D) 64dB – Overall level	Tone present Junction of 1 plane (Q=2) - facade
Reductions due to distance, barrier & conversion to Sound Pressure Level	-10dB -10dB – Total reduction	$L_2 = L_1 - 20\log(r_2/r_1)$ 3m
Rating Level	54dBA – at facade	
Background Sound level	39dBA L _{A90 1hour}	Measured at receptor
Excess of rating over background	(54-39) = +15dB – Cooling	
Assessment indicates adverse impact at receptor		The installation of plant will have an adverse impact at the receptor location

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7 x wall mounted units – Heating

<i>Results</i>		<i>Commentary</i>
Combined Ambient Sound Level	Sound Pressure Level = 62dB L _p – Heating	Taken from manufacturer & combined level using decibel addition Total for 7 units
Residual Sound Level	43dBA Taken at evening time	Measured at receptor
Combined Specific Sound Level	62dB	$L_s = 10\log(10L^{9/10} + 10L^{7/10})$
Acoustic Feature Correction	+2 for tonality +3dB for Directivity (D) 67dB – Overall level	Tone present Junction of 1 plane (Q=2) - facade
Reductions due to distance, barrier & conversion to Sound Pressure Level	-10dB -10dB – Total reduction	L2 = L1 – 20log (r2/r1) 3m
Rating Level	57dBA – at facade	
Background Sound level	39dBA L _{A90 1hour}	Measured at receptor
Excess of rating over background	(57-39) = +18dB – Cooling	
Assessment indicates adverse impact at receptor		The installation of plant will have an adverse impact at the receptor location

6.7 Night Time Results Table – 0000-0700hrs:

1 x unit working on Silent Mode

<i>Results</i>		<i>Commentary</i>
Ambient Sound Level	Sound Pressure Level = 44dB L _p – silent mode	Taken from manufacturer
Residual Sound Level	37dBA taken between 2300-0000	Measured at receptor
Specific Sound Level	43dB	$L_s = 10\log(10L^{9/10} + 10L^{7/10})$
Acoustic Feature Correction	+2 for tonality +3dB for Directivity (D) 48dB – Overall level	Tone present Junction of 1 plane (Q=2) - Facade
Reductions due to distance, barrier & conversion to Sound Pressure Level	-10dB – worst case -10dB – Total reduction	L2 = L1 – 20log (r2/r1) 3m
Rating Level	38dBA – at facade	
Background Sound level	34dBA L _{A90 15mins}	
Excess of rating over background	(38-34) = +4dB – Cooling & heating	
Assessment indicates adverse impact at receptor		The installation of plant will have an marginal adverse impact at the receptor location

7 Rating Sound Levels:

7.1 The table below shows the overall rating levels for the proposed plant in relation to the background noise levels.

Location	Rating Level	Background Noise Level	Difference	Assessment Indicates
Day Time – Dwelling Cooling Heating	54dBA 57dBA	41dBA	+13dB +16dB	Adverse Impact Adverse Impact
Night Time – Dwelling Cooling Heating	54dBA 57dBA	39dBA	+15dB +18dB	Adverse Impact Adverse Impact
Reduced Rate – night Time Cooling Heating	38dBA	34dBA	+4dB	Marginal Impact

7.2 The table above clearly shows the rating levels apparent at the residential facade.

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8 Conclusion:

8.1 The results clearly indicate that without any mitigation measures implemented to the plant, it will have an adverse impact on the residential dwelling located to the South. Therefore mitigation measures will be required to all 7 condenser units.

8.2 Please note that this assessment indicates worst case scenario of having all 7 units in operation during hours of operation (except for night time reduced rate mode). Once the necessary climate etc. has been established it may be apparent that not all units will require mitigation. However a clear strategy indicating which units will be in operation has not been received, so the worst case scenario of having all 7 units in operation has been used.

8.3 There is existing plant located in the vicinity of the proposed and this was measured as part of the background noise levels. This plant was switched off circa 2330-0000hrs, which would coincide with the closing of the public house.

8.4 It is clear that mitigation measures will be required to all plant at the site location. The products listed below offer the necessary level of mitigation to ensure the lowest L_{A90} value and therefore the NOEL values are met.

Product	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	8KHz
Quietbox VI	14	20	26	28	26	23	22

8.5 It is recommended that the Quietbox VI is installed around the wall mounted units. This level of mitigation may seem excessive but the installation of 7 condensing units to a traditionally quiet location will increase the background noise levels. The Quietbox is an acoustic enclosure that should offer a sound reduction of approximately 20dBA for AC units of this type.

8.6 It must be pointed out that the calculated noise levels with no mitigation should not have an adverse impact on the dwellings located beyond the car park due to the extra distance, screening offered by buildings and other noise sources in operation. It must be stressed however that no calculations have been performed for these dwellings at all.

8.7 Whilst it is clear that the plant will have an adverse impact during the day time if no mitigation measures were implemented, but it is anticipated that higher noise levels during the day time will not have as much of an adverse impact as they would have at night time therefore ensuring the night time noise levels are met is essential compared to the day time levels.

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9 Mitigation Measures & Revised results tables:

9.1 The following tables show the calculated noise levels at the residential façade with the products listed above included within the calculations.

All 7 Units combined - Cooling										
	63	125	250	500	1K	2K	4K	8K	Overall	
SPL – All Units	62	62	60	58	54	49	43	36	67	dB
	-26	-26	-9	-3	0	1	1	-1		
SPL dBA	36	36	51	55	54	50	44	35	59	dBA
Distance	3	3	3	3	3	3	3	3		
DI	3	3	3	3	3	3	3	3		
Point Source Attenuation	10	10	10	10	10	10	10	10		
Silencer	4.00	14	20	26	28	26	23	22		
Tonality	2	2	2	2	2	2	2	2		
Level at Room	27	17	26	24	21	19	16	8	32	
Day time BGN									41	dB
Evening time BGN									39	dB
						Excess below day time BGN			-9	dB
						Excess below Night time BGN			-7	dB
All 7 Units combined - Heating										
	63	125	250	500	1K	2K	4K	8K	Overall	
SPL - All Units	64	64	65	60	55	51	47	41	70	dB
	-26	-26	-9	-3	0	1	1	-1		
SPL dBA	38	38	56	57	55	52	48	40	62	dBA
Distance	3	3	3	3	3	3	3	3		
DI	3	3	3	3	3	3	3	3		
Point Source Attenuation	10	10	10	10	10	10	10	10		
Silencer	4.00	14	20	26	28	26	23	22		
Tonality	2	2	2	2	2	2	2	2		
Level at Room	29	19	31	26	22	21	20	13	35	
Day time BGN									41	dB
Evening time BGN									39	dB
						Excess below day time BGN			-6	dB
						Excess below Night time BGN			-4	dB

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9.2 The table above shows that the combined cooling level will be 32dBA which is -9dB below the L_{A90} for the day time period and -7dB below the L_{A90} for the time period between 2300-0000hrs so this would indicate no adverse impact on the residential dwelling. It also shows that the combined heating level will be 35dBA which is -6dB below the day time L_{A90} and -4dB below the evening time L_{A90} , again indicating no adverse impact at the residential façade. These rating levels would also meet the requirements of the local authority of achieving a No Observed Effect Level (NOEL) for the dwelling. This is a value below which no detectable effect on health can be detected due to noise.

Silent Mode – Night Time:

The frequency data for the 4MX80E silent mode is not available but it is understood to be 44dBA at 1m. The BS4142 results table indicate that the rating level would be 38dBA at the façade which is only +4dB above the L_{A90} for the night time period thus if the Quietbox VI is installed around the units as recommended then it is evident that based on the levels of reduction attributed to the attenuator that the rating level during the night time would be significantly below the L_{A90} value and therefore have no adverse impact on the residential dwelling.

9.3 It is clear that if the mitigation measures listed within this report (or similar products) are implemented then the resultant noise levels should not have an adverse impact on the residential dwellings located to the South. The insertion loss data has been received by the manufacturer and he has insisted that the levels of mitigation can be met.

9.4 It may be worth establishing the exact number of units that will be on at any one time, as this may affect the results but no clear indication of which units will be in operation has been received.

9.5 It must also be noted that to achieve internal compliance for BS8233: 2014 at the residential dwelling the overall level of mitigation will not be as severe as listed within this report. The recommended internal noise level for a bedroom is 30dB $L_{Aeq\ 8hour}$, which would represent an external level of 43dB as an open window offers a sound reduction of 13dB.

9.7 This level of mitigation would still ensure that the internal acoustic criteria can be met without having an adverse impact on the residential dwelling.

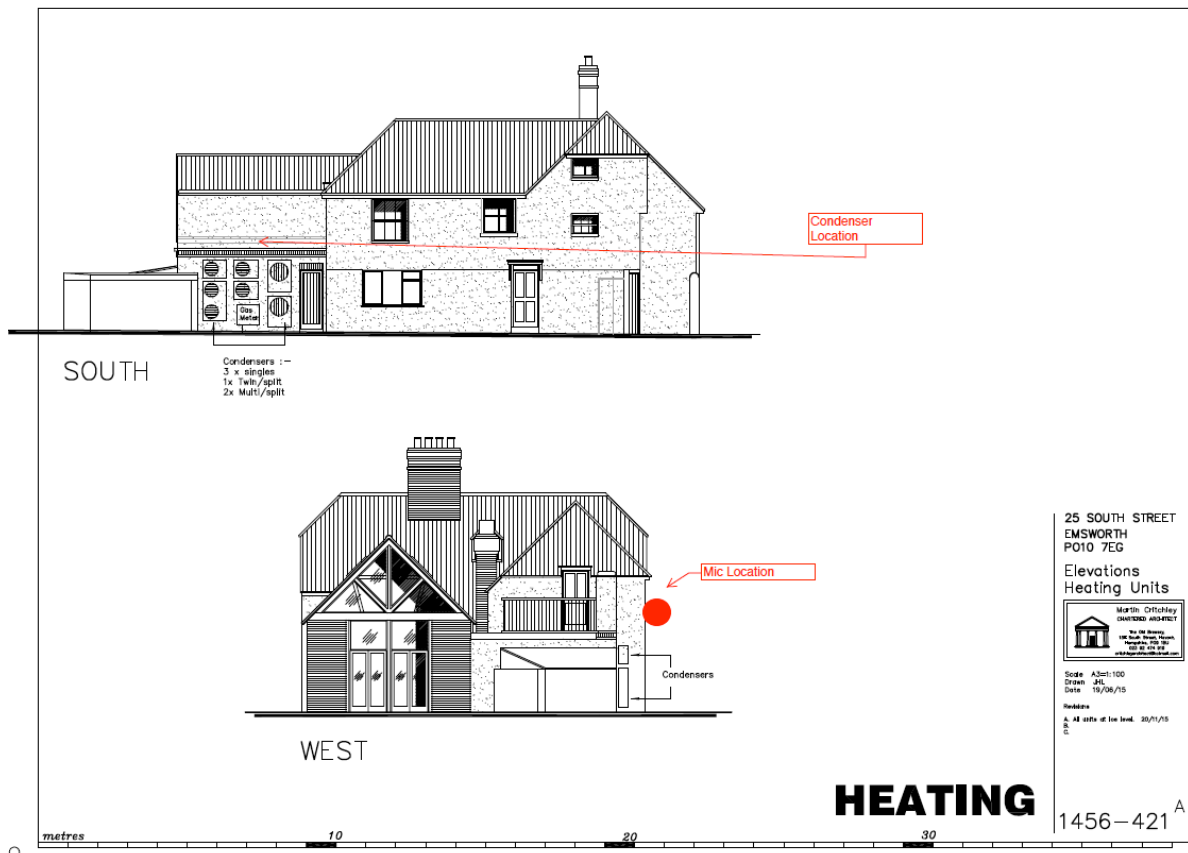
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10 Google Earth:



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11 Site Plan:



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12 Appendix:

Continuous equivalent noise level, LAeq — The steady noise level (usually in dBA) which, over the period of time under consideration, contains the same amount of sound energy as the time varying noise.

LAm_{ax} - The maximum value that the A-weighted sound pressure level reaches during a measurement period.

dB (A) — The A-weighted sound pressure level.

Decibel (dB) — A unit used for many acoustic qualities to indicate the level of sound with respect to a reference level.

A-weighting — A frequency weighting that relates to the response of the human ear.

Background noise level — Prevailing noise level in a specified environment measured in the absence of the noise being studied.

Habitable Room – A room used for sleeping or recreation/relaxation

LA90 - The A-weighted noise level exceeded for 90% of the measurement duration.

British Standards & associated documents:

- BS4142: Methods for rating and assessing industrial and commercial sound - 2014

- Code of Practice: BS8233: 2014 - Sound Insulation and noise reduction for buildings.

Acoustic feature correction of +2dB has been added for Tonality as it is understood that a tone is present and that this tone will just be perceptible at the noise receptor.

The plant will not be impulsive or intermittent at the receptor.

Directivity figure taken from Acoustics & Noise Control 2nd edition – Smith, Peters & Owen

Quietbox Insertion Loss data – Taken directly from Manufacturer

QuietBox VI	Frequency (Hz)						
	125	250	500	1k	2k	4k	8k
Insertion Loss (dB) - 1DP	14	20	26	28	26	23	22

