

Acoustic Consultancy Report

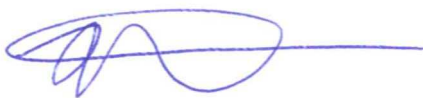
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M&S SF Waterlooville External Plant Assessment

Report Prepared For

Wates Retail
M&S Acoustic Surveys
16 September 2013

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i) Executive Summary

New mechanical plant is to be installed at the M&S Simply Food development, in Waterloooville.

LCP has been commissioned by Wates Retail to carry out a background noise survey and to use the obtained data to assess the noise impact of the plant installation on surrounding noise sensitive receptors.

The lowest background noise level measured during the night period was 35 dB $L_{A90,5 \text{ mins}}$.

A BS4142:1997 assessment has been carried out to determine the likely impact on nearby residential receivers.

The assessment yielded a result between 'complaints are unlikely' and 'marginal significance', with calculated night rating levels of 28 dB $L_{Aeq,T}$.

The calculated noise levels are also acceptable according to BS8233 and WHO Guidelines for Community Noise.

It is therefore recommended that planning permission in respect of the plant installation shall be given.

ii) Document History

Issue	Date	Issue Details	Issued By	Checked By
1	16 th September 2013	Initial Issue	JN	MB

1 Introduction

New mechanical plant is to be installed at the M&S Simply Food development, in Waterloooville.

LCP has been commissioned by Wates Retail to carry out a background noise survey and to use the obtained data to assess the noise impact of the plant installation on surrounding noise sensitive receptors.

The guidance in this report is on the basis that the mechanical plant will be operating over a 24 hour period.

2 Site Description

The site layout together with the measurement position is shown in the drawing contained within Appendix A.

3 Local Noise Climate

The predominant local noise source was road traffic noise from the A3.

4 Measurements

The noise monitoring took place from 9th to 10th September 2013. The measurement period was considered sufficient to establish the lowest background noise levels corresponding to the operational period of the plant.

The weather conditions during the survey were calm and dry.

5 Results

The measured statistical broad-band sound pressure levels are shown within Appendix B. The lowest representative background noise level(s) obtained being as follows:

Table 1: Lowest measured background noise levels, dB re 2×10^{-5} Pa

Measurement Position	$L_{A90, 5 \text{ mins}}$ Night*
MP1	35

* Day and Night periods are defined in BS4142:1997 as between 07:00 and 23:00, and 23:00 and 07:00 respectively.

6 Evaluation of Design Criteria

6.1 Residential Design Criterion

It is recommended in this instance that an assessment in accordance with BS4142:1997 is carried out.

6.1.1 BS4142:1997

BS4142:1997 states that the 'likelihood of complaints' are to be assessed by subtracting the measured background noise level from the calculated rating level. The following table demonstrates the resultant assessments based upon the calculated rating level.

Table 2: BS4142 assessment based upon rating level

Difference between background noise and rating levels	Assessment
+ 10 dB	Complaints are likely
+ 5 dB	Marginal significance
- 10 dB	Complaints are unlikely

In acoustic terms, a calculated rating level 10 dB below the measured background noise level means that the measured background noise level is not increased.

The tables below relate the above BS4142 assessment levels against the lowest night time noise levels measured on the survey.

Table 3: Night time BS4142 assessment based upon rating level, dB re 2×10^{-5} Pa

Lowest measured background	BS4142 Level	Assessment
35	45	Complaints are likely
	40	Marginal significance
	25	Complaints are unlikely

An explanation of the effects of changes in the difference between the rating level and the background noise level can be found in the glossary in Appendix F. The corresponding subjective change in loudness is described.

BS4142:1997 also states that background noise levels below about 30 dB and rating levels below about 35 dB are considered to be very low.

6.1.2 BS8233:1999

The criteria offered in BS8233 for residential buildings are largely based on the recommendations made in the Guidelines for Community Noise. BS8233 gives internal criteria for bedrooms and living rooms for both 'reasonable' and 'good' resting/sleeping conditions.

BS8233 also gives general guidance on the expected sound insulation performance of a given building façade, with details of how various elements can affect the overall performance. Concerning windows, it states that:

“...if windows are intended to be opened to provide rapid ventilation and summer cooling, the insulation will reduce to about 10 dB or 15 dB...”

This infers that should windows on a noise affected façade be openable, a sound insulation value of 10-15 dB should be applied to the whole façade to an internal room being assessed. On this basis, the criteria shown in the table below have been adapted from the criteria offered in table 5 of BS8233 in order to obtain acceptable external noise levels.

The noise levels shown should be treated as overall noise levels, i.e., the combination of all existing noise levels at the site, and noise levels from any proposed plant or activity.

Table 4: BS8233 criteria, dB re 2×10^{-5} Pa

External Facade	Design Range $L_{Aeq, T}$		L_{Amax}^*
	Good	Reasonable	
Living Rooms	40	50	n/a
Bedrooms	40	45	55

* Fast time weighting

In addition to the above criteria, BS8233 goes on to say:

“In gardens and balconies etc it is desirable that the steady noise level does not exceed 50 $L_{Aeq, T}$ dB and 55 dB $L_{Aeq, T}$ dB should be regarded as the upper limit.”

The above criteria are in line with the recommendations made in WHO's 'Guidelines for Community Noise'.

7 Review of Plant Installation

Eight pieces of plant are to be located in the plant area to the rear of the store on a raised platform as indicated on the site plan in Appendix A and the plant area drawings in Appendix B. There is no direct line of sight to the plant area from the nearest residential properties.

Calculations of the predicted noise levels have been carried out with the appropriate corrections for barrier effects, geometric attenuation, reflective surfaces and multiple source addition. The design rating levels to be adopted for this project, together with the predicted noise levels, are set out in the table below.

Table 5: Predicted and design noise levels, dB re 2×10^{-5} Pa

Receiver Premises	Approx. Distance (m)	Predicted Level $L_{Aeq, 8 \text{ hr}}$
Nearest residential on Freshfield Gardens	125	28

The BS4142 assessment for night time operation is therefore between 'complaints are unlikely' and 'marginal significance'. The calculated noise levels are also acceptable according to BS8233:1999 and WHO Guidelines for Community Noise.

Plant noise level data used in this assessment are contained within Appendix D. Calculations are shown within Appendix E.

8 Conclusion

An environmental noise survey has been undertaken in order to establish the existing background noise levels local to the site generally in accordance with the method contained within BS4142: 1997.

Calculations have been carried out to determine the noise levels at the nearest receiver premises. The calculations yield a BS4142 assessment between 'complaints are unlikely' and 'marginal significance'. The calculated levels are acceptable according to BS8233 and WHO Guidelines for Community Noise.

It is therefore recommended that planning permission in respect of the plant installation shall be given.



Appendix A: Site Plan



Google earth

feet
meters

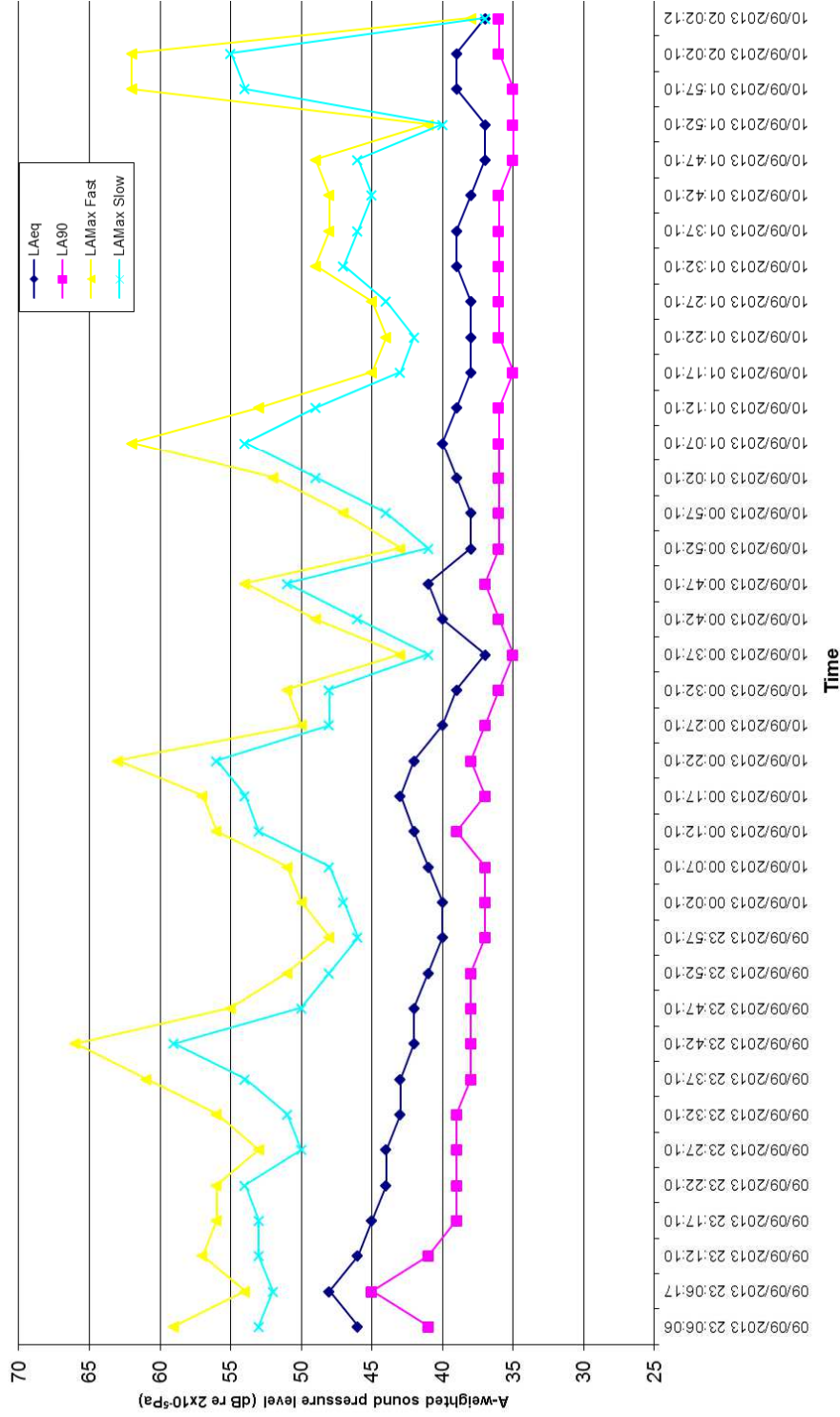
1000

400





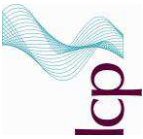
Appendix C: Measurement Data



Sound pressure level measurements were obtained using the following instrumentation complying with the Class 1 specification of BS EN 61672:2003

- Svantek 959 Sound Level Meter S/N: 1120
- Svantek pre-amplifier SV12L S/N: 13245 with GRAS microphone capsule 40AE S/N: 75181

Calibration checks were made prior to and after completion of measurements using a Svantek SV30A calibrator, S/N: 10892 complying with Class 1 specification of BS EN 60942:2003, calibration level 94.0 dB @ 1.0 kHz. All acoustic instrumentation carried current manufacturer's certificates of conformance.



Appendix D: Plant Data

Table 6: Manufacturer's plant sound data, dB

Plant Ref	Plant	Reference Distance	Octave Band Centre Frequency (Hz)								L _A
			63	125	250	500	1k	2k	4k	8k	
HT1	Searle CCU100	L _p at 10m	32	32	39	39	38	34	26	20	42
HT1/1	Searle HT1 Condensers	L _w	67	66	67	64	67	65	59	51	71
HT1/2											
X1/1	Searle NSQ15-3LS-A2WI-PC*	L _p at 10m	59	48	40	35	31	28	26	24	40
Z1/2	Searle NSQ26-3MX-C2WI-PC*	L _p at 10m	59	48	40	35	31	28	26	24	40
-	Rivacold HUM 140*	L _p at 10m	60	49	41	36	32	29	27	25	41
-	AC Condensers	L _p at 1m	53	52	49	45	43	39	32	30	48

* The sound pressure spectrum for this unit has been estimated based upon the manufacturer's single figure broadband value.



Appendix E: Calculations

Ref.	plant	Ref. dist.	Sound Level (Lp/Lw)								Lw	Receiver Distance (m)	dB(A)	Lp	No. off	dB	Angular Directionality	63	125	250	500	1k	2k	4k	8k	Reflections	dB	Facade correction
1	Searle CCU100	10.00	63	125	250	500	1k	2k	4k	8k	dB(A)		20	1	0	None	0	0	0	0	0	0	0	0	1	3	Yes	
2	Searle HT1 Condensers		67	66	67	64	67	65	59	51	71	71	21	2	3	None	0	0	0	0	0	0	0	0	1	3	Yes	
3	Searle NSQ15-3LS-A2WI-PC	10.00	59	48	40	35	31	28	26	24	40	68	18	1	0	None	0	0	0	0	0	0	0	0	1	3	Yes	
4	Searle NSQ26-3MX-C2WI-PC	10.00	59	48	40	35	31	28	26	24	40	68	18	1	0	None	0	0	0	0	0	0	0	0	1	3	Yes	
5	Rivacold HUM 140	10.00	60	49	41	36	32	29	27	25	41	69	19	1	0	None	0	0	0	0	0	0	0	0	1	3	Yes	
6	AC Condensers	1.00	53	52	49	45	43	39	32	30	48	56	6	2	3	None	0	0	0	0	0	0	0	0	1	3	Yes	

Barrier Path Difference Loss:																													
Ref.	plant		Receiver Lp										Barrier Path Difference Loss:																
			63	125	250	500	1k	2k	4k	8k	dB(A)	Source height	Receiver height	Barrier height	Source to barrier distance	Barrier to receiver distance	Calculated path difference	63	125	250	500	1000	2000	4000	8000				
1	Searle CCU100		16	16	23	23	22	18	10	4	26	5.0	3.0	5.0	36.0	89.0	0.01	-5	-5	-5	-5	-6	-7	-8	-10				
2	Searle HT1 Condensers		26	25	26	23	26	24	18	10	30	5.0	3.0	5.0	36.0	89.0	0.01	-5	-5	-5	-5	-6	-7	-8	-10				
3	Searle NSQ15-3LS-A2WI-PC		43	32	25	19	15	12	10	8	24	5.0	3.0	5.0	36.0	89.0	0.01	-5	-5	-5	-5	-6	-7	-8	-10				
4	Searle NSQ26-3MX-C2WI-PC		43	32	25	19	15	12	10	8	24	5.0	3.0	5.0	36.0	89.0	0.01	-5	-5	-5	-5	-6	-7	-8	-10				
5	Rivacold HUM 140		44	33	26	20	16	13	11	9	25	5.0	3.0	5.0	36.0	89.0	0.01	-5	-5	-5	-5	-6	-7	-8	-10				
6	AC Condensers		20	19	16	12	10	6	-1	-3	15	5.0	3.0	5.0	36.0	89.0	0.01	-5	-5	-5	-5	-6	-7	-8	-10				
Total			48	38	32	28	28	26	20	16	33																		

Criteria																		
NR	63	125	250	500	1k	2k	4k	8k	dB(A)									
25	55	44	35	29	25	22	20	18	35									
										Barrier SRI								
											Manual							
											Unknown							
										63	125	250	500	1k	2k	4k	8k	Rw
																		0
																		101

Ref.	Plant	Excess																						
63		125	250	500	1k	2k	4k	8k	dB(A)															
1	Searle CCU100	-39	-28	-12	-6	-3	-4	-9	-14	-9														
2	Searle HT1 Condensers	-29	-19	-9	-6	1	2	-1	-8	-5														
3	Searle NSQ15-3LS-A2WI-PC	-12	-11	-11	-10	-10	-10	-10	-10	-11														
4	Searle NSQ26-3MX-C2WI-PC	-12	-11	-11	-10	-10	-10	-10	-10	-11														
5	Rivacold HUM 140	-11	-10	-10	-9	-9	-9	-9	-9	-10														
6	AC Condensers	-35	-25	-19	-17	-15	-16	-20	-21	-20														
Total		-7	-6	-3	-1	3	4	1	-2	-1														

Ref.	Plant	Mitigated Receiver Lp																						
63		125	250	1k	2k	4k	8k	dB(A)																
1	Searle CCU100	11	11	18	18	16	12	2	-6	20														
2	Searle HT1 Condensers	21	20	21	18	20	18	10	0	24														
3	Searle NSQ15-3LS-A2WI-PC	38	27	20	14	9	6	2	-1	18														
4	Searle NSQ26-3MX-C2WI-PC	38	27	20	14	9	6	2	-1	18														
5	Rivacold HUM 140	39	28	21	15	10	7	3	0	19														
6	AC Condensers	15	14	11	7	4	0	-9	-13	9														
Total		43	33	27	23	19	13	7	28															

Appendix F: Glossary

The list below details the major acoustical terms and descriptors, with brief definitions:

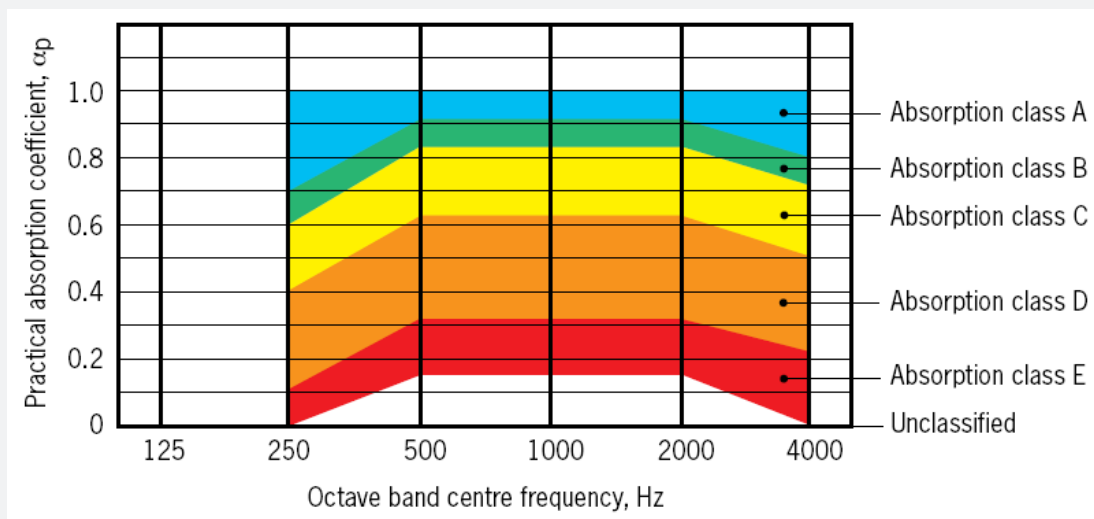
'A' Weighting

Weighting applied to the level in each stated octave band by a specified amount, in order to better represent the response of the human ear. The letter 'A' will follow a descriptor, indicating the value has been 'A' weighted. An 'A' weighted noise level may also be written as dB(A).

Absorption Class

In order to categorise the absorptive effects of different elements (such as ceiling tiles), classes from A to E were derived, as per BS EN ISO 11654:1997. A class 'A' absorber would be very acoustically absorptive, a Class 'E' absorber would be less absorptive and more reflective. A product that is highly reflective may not be classified.

The chart shown below has been extracted from BB93, and demonstrates the characteristics of each class according to BS EN ISO 11654:1997.



Absorption Coefficient (α)

A value usually between 0 and 1 assigned to a material to indicate how acoustically absorptive it is. 0 indicates a material is entirely reflective (and therefore not absorptive), and 1 indicates a material is entirely absorptive (and therefore not reflective). Absorption coefficients are usually given for each octave band between 125Hz and 4kHz, or as an overall 'practical' coefficient.

Airborne Noise

Noise transmitted through air.

Ambient Noise

The total noise level including all 'normally experienced' noise sources.

dB or Decibel

Literally meaning 'a tenth of a bel', the bel being a unit devised by the Bell Laboratory and named after Alexander Graham Bell. A logarithmically based descriptor to compare a level to a reference level. Decibel arithmetic is not linear, due to the logarithmic base. For example:

30 dB + 30 dB $\neq$ 60 dB

30 dB + 30 dB = 33 dB

$D_{nTw} + C_{tr}$

The weighted, normalised difference in airborne noise levels measured in a source room (L1) and a receive room (L2) due to a separating partition.

D	Is simply $L1 - L2$.
D_{nT}	Is the normalisation of the measured level difference to the expected (in comparison to the measured) reverberation time in the receiving room.
D_{nTw}	Is the weighted and normalised level difference. This value is the result of applying a known octave band weighting curve to the measured result.
C_{tr}	Is a correction factor applied to the D_{nTw} to account for the known effects of particular types of noise, such as loud stereo music or traffic noise.

Frequency (Hz)

Measured in Hertz (after Heinrich Hertz), and represents the number of cycles per second of a sound or tone.

Impact Noise

Re-radiated noise as a result of impact(s) on a solid medium, such as footfalls on floors. Measured in L'_{nTw} .

Insertion Loss, dB

The amount of sound reduction offered by an attenuator or louvre once placed in the path of a noise level.

$L_{A90, T}$

The 'A' weighted noise level exceeded for 90% of the time period T, described or measured. The '90' can be substituted for any value between 1 and 99 to indicate the noise level exceeded for the corresponding percentage of time described or measured.

$L_{Aeq, T}$

The 'A' weighted 'equivalent' noise level, or the average noise level over the time period T, described or measured.

L_{Amax}

The 'A' weighted maximum measured noise level. Can be measured with a 'slow' (1 sec) or 'fast' (0.125 sec) time weighting.

L_{Amin}

The 'A' weighted minimum measured noise level.

L'_{nTw}

The weighted, normalised impact sound pressure level measured in a receive room below a source room.

L

Is the spatially averaged impact sound pressure level measured in a receive room.

L'_{nT}

Is the normalisation of the measured impact sound pressure level to the expected (in comparison to the measured) reverberation time in the receiving room.

L'_{nTw}

Is the weighted and normalised impact sound pressure level. This value is the result of applying a known octave band weighting curve to the measured result.

NR

Noise Rating (NR) level. A frequency dependent system of noise level curves developed by the International Organisation for Standardisation (ISO). NR is used to categorise and determine the acceptable indoor environment in terms of hearing preservation, speech communication and annoyance in any given application as a single figure level. The US predominantly uses the Noise Criterion (NC) system.

Octave

The interval between a frequency in Hz (f) and either half or double that frequency (0.5f or 2f).

Pa

Pascals, the SI unit to describe pressure, after physicist Blaise Pascal.

Reverberation Time, T_{mf} , RT60, RT30 or RT20

The time taken in seconds for a sound to diminish within a room by 1,000 times its original level, corresponding to a drop in sound pressure of 60 dB. When taking field measurements and where background noise levels are high, the units RT20 or RT30 are used (measuring drops of 20 or 30 dB respectively). Sometimes given as a mid-frequency reverberation time, T_{mf} which is the average of reverberation time values at 500Hz, 1kHz and 2kHz.

R_w

The sound reduction value(s) of a constructional element such as a door, as measured in a laboratory, with a known octave band weighting curve applied to the result.

Sound Power Level

A noise level obtained by calculation from measurement data, given at the face of an item of plant or machinery. Referenced to 10^{-12} W or 1pW.

Sound Pressure Level

A noise level measured or given at a distance from a source or a number of sources. Referenced to 2×10^{-5} Pa.

Speech Intelligibility, Speech Transmission Index (STI)

Speech intelligibility is the measure of how well a speaker's voice can be heard within a given space. Speech intelligibility within a room depends on a number of factors, including reverberation time and background noise.

The Speech Transmission Index or STI has emerged as the favoured method of describing speech intelligibility.

Subjective Effect of Changes in Sound Pressure Level

A basic example to illustrate the assessment of difference in noise levels follows.

A background noise survey is undertaken that yields a lowest background noise level of L_{A90} 30 dB.

As the existing background noise level is low, a rating level for new plant noise of $L_{Aeq, T}$ 30 dB is set.

After calculation, the plant noise is predicted to achieve $L_{Aeq,T}$ 30 dB at the nearest residential property.

After the addition of the plant predicted noise level (or Rating Level), the new overall ambient noise level will be 33 dB. The background noise level measured originally will therefore be increased by 3 dB. In terms of the subjective impression of an increase of this order, the change in levels will be 'just perceptible'.

The table below details the subjective effects of variations in sound pressures (adapted from Bies and Hansen).

Difference between background noise and rating levels	Increase in ambient noise level in 'real terms'	Change in apparent loudness
+ 10 dB	+ 10 dB	Twice as loud
+ 5 dB	+ 6 dB	Clearly noticeable
0 dB	+ 3 dB	Just perceptible
-10 dB	0 dB	No change

W

Watts, the SI unit to describe power, after engineer James Watt.