



# Pendle Hill High School

## Post Completion Noise Compliance Testing

**Taylor Construction**

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## **1 INTRODUCTION**

Pulse White Noise Acoustics PTY LTD has been engaged to undertake post completion acoustic compliance testing of the operational noise resulting from the mechanical system serving the completed Pendle Hill High School project.

Noise level measurements were conducted in conjunction with the projects Condition of Consent including Items E8 and E9 of the projects SSD 9579147 Conditions of Consent which includes reference to the Aurecon Pendle Hill High School SSD Application – Acoustic Assessment Reference number 507914, Revision 3

Acoustic testing of the operational school has been undertaken for the completed project.

A glossary of terminology used in this report is provided in Appendix A.

## 2 PROJECT DESCRIPTION

The school currently operates as a high school for students from year 7 to 12 and includes 5 two-storey buildings (Buildings A, B, C, D & E). There are several active recreational areas associated with the school, which include, football fields, tennis courts, basketball courts, cricket nets and an oval. The existing on-site parking is located to the south-west of the site and is split into three parts with a total capacity of 72 spaces. The total redevelopment of Pendle Hill High School is proposed for expansion to a Stream 12 high school, with the scope of works for this SSD-9579147 application proposed to include:

1. Construction of a new three-storey courtyard building on Binalong Road (Building H), comprising two (2) three-storey wings under a connected roof, which will accommodate a library, staff unit, lecture theatre, multimedia and senior learning spaces, administration unit and student amenities.
2. External transport infrastructure upgrade works.
3. New covered walkways and upgraded landscaping.
4. New hard stand areas for bicycle parking.
5. Removal of 15 non-compliant car parking spaces (primarily in the northern most part of the car park) reducing total capacity of on-site parking from 72 spaces to 57 spaces.

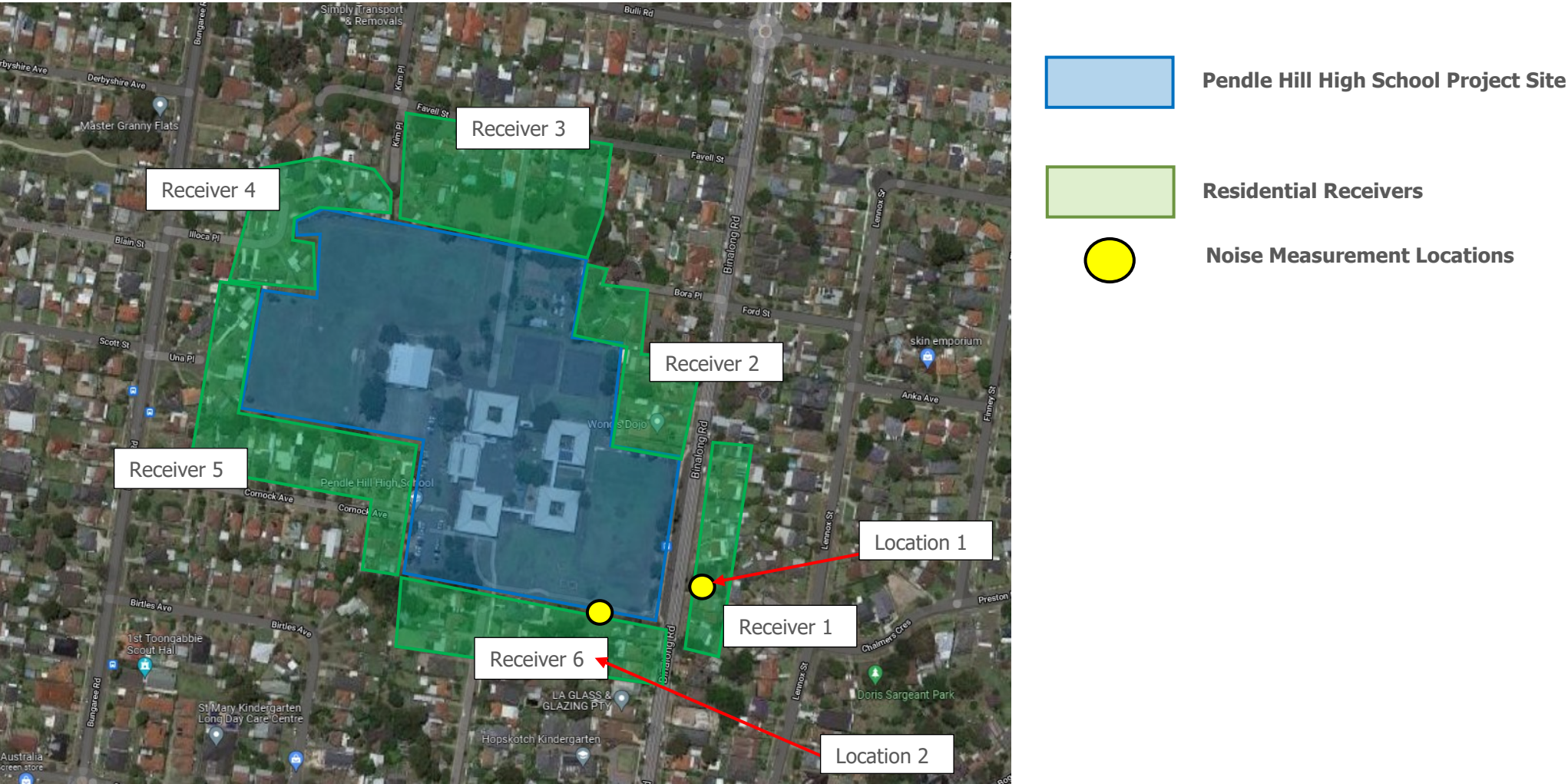
The site is located to the west of Binalong Road the works to be conducted as part of the constructions include buildings within the exiting school grounds. See Figure 1 below.

Residential receivers which are located within proximity to the site include a combination of single and two storey dwellings with windows overlooking the school property. The nearest sensitive receivers to the site have been identified below.

- Receiver 1:** Single and two storey residential dwellings located to the east of the school located along Binalong Road.
- Receiver 2:** Single and two storey residential dwellings located to the northeast of the school on Binalong Road and Bora Place.
- Receiver 3:** Single and two storey residential dwellings located to the north of the school on Favell Street and Kim Place.
- Receiver 4:** Single and two storey residential dwellings located to the northwest of the school on Illoca and Kim Place.
- Receiver 5:** Single and two story residential dwellings located to the west of the school on Una Place, Cornock Avenue and Binalong Road.
- Receiver 6:** Single and two storey residential dwellings located to the south of the school on Knox Street.

A site map has been provided below which identifies surrounding receivers and monitoring locations, see figure below.

Figure 1 - Site Map and Surrounding Noise Receivers





### 3 PROJECT NOISE LEVEL CRITERIA

Noise levels testing conducted as part of the assessment includes the required levels detailed in Items E8 and E9 of the projects SSD 9579147 Conditions of Consent which includes reference to the Aurecon Pendle Hill High School SSD Application – Acoustic Assessment Reference number 507914, Revision 3

#### Operational Noise Limits

- E8. The Applicant must ensure that noise generated by operation of the development does not exceed the noise limits in Pendle Hill High School SSD Application Acoustic Assessment dated 30 April 2021 and prepared by Aurecon.
- E9. The Applicant must undertake short term noise monitoring in accordance with the *Noise Policy for Industry* where valid data is collected following the commencement of use of the development. The monitoring program must be carried out by an appropriately qualified person and a monitoring report must be submitted to the Planning Secretary within two months of commencement use of each stage of the development or other timeframe agreed to by the Planning Secretary to verify that operational noise levels do not exceed the recommended noise levels for mechanical plant identified in Acoustic Assessment prepared by Aurecon dated 30 April 2021. Should the noise monitoring program identify any exceedance of the recommended noise levels referred to above, the Applicant is required to implement appropriate noise attenuation measures so that operational noise levels do not exceed the recommended noise levels or provide attenuation measures at the affected noise sensitive receivers.

Section 5.2.4 (Summary of Operational Noise Emissions) of the Aurecon Pendle Hill High School SSD Application – Acoustic Assessment Reference number 507914, Revision 3, includes the project required noise level emissions criteria as project noise trigger levels for the operation of building services, including the following:

#### 5.2.4 Summary of operational noise criteria

The relevant project specific operational noise criteria are summarised in Table 5-5 below.

**Table 5-5: Project operational noise criteria for surrounding affected residences**

Operational noise element	Time period	Project operational noise criteria <sup>4</sup>
Outdoor play areas ( <b>Assessment 2a</b> )	Daytime (7am – 6pm)	49 dB(A) <sub>Leq(15min)</sub> – NSWLEC decisions and AAAC guideline 53 dB(A) <sub>Leq(15min)</sub> – NPfI project amenity level
Building H – school bell, PA system, building services plant and after-hours use ( <b>Assessment 2b</b> )	Daytime (7am – 6pm)	44 dB(A) <sub>Leq(15min)</sub>
Additional traffic on surrounding public roads ( <b>Assessment 2c</b> )	Daytime (7am – 6pm)	Binalong Rd – 60 dB(A) <sub>Leq(15hour)</sub> (external) All other roads – 55 dB(A) <sub>Leq(1hour)</sub> (external)

## 4 OPERATIONAL NOISE LEVEL MEASUREMENTS

Attended noise level measurements of the operation of the mechanical system serving the Pendle Hill High School was conducted at the boundary of the nearest residential receivers within proximity to the school, further detail of the measurement locations can be identified in Figure 1 above.

Testing was conducted on the 20<sup>th</sup> of June 2023 during a period when all the building services were operational including the external condenser equipment.

Testing was undertaken as part of the completed school in total.

The noise level survey was performed using a Brüel & Kjær Hand-held Analyser Type 2270 type meter. Calibration of the sound level meter was checked with a Brüel & Kjær Type 4231 acoustical calibrator prior to and following the measurements. Drift in calibration did not exceed  $\pm 0.5$  dBA. All equipment carried current NATA calibration certificates.

Attended measurements took place between 11.00am and 11:30am on the 20<sup>th</sup> of June 2023.

Prior to all the noise measurements being undertaken all ventilation and air conditioning systems were checked to be operational and were confirmed by the mechanical contractor as to being in operation.

The noise level testing undertaken as part of the compliance testing was undertaken in accordance with the requirements of the EPA's Noise Policy for Industry and the relevant Australian Standards including AS1055:2018 'Acoustics – Description and Measurement of Environmental Noise.

The attended and unattended noise locations were selected to obtain suitable noise levels for the normal operation of the mechanical services equipment and the projects noise level criteria as detailed in the SSD and the projects Noise Impact Assessment which are detailed in the section above.

Noise levels at the school was undertaken in accordance with the requirements of the EPA and the testing methodologies of AS1055. Details of the testing are included in this Section of the report.

The project noise level criteria is based on Items E8 and E9 of the projects SSD 9579147 Conditions of Consent which includes reference to the Aurecon Pendle Hill High School SSD Application – Acoustic Assessment Reference number 507914, Revision 3

The period of the testing undertaken at as part of the Operational Noise Compliance Testing included 15 min period.

The period of testing was undertaken as this was identified as a representative period when the school was operational at a normal maximum capacity, including the building services equipment and the like.

The noise level test location includes that which are representable of the potentially worst affected receivers, including those located to the east and south of the project site as identified in Figure 1.

The testing was undertaken during the period when the equipment was operational at maximum capacity. Details of the operation of the plant provided to this office has indicated that the major plant is not operational at maximum capacities during night time hours.

The results of measured external noise levels during a period when the building services operating under normal conditions are detailed in the table below.



**Table 1 - Measured External Noise Levels**

Measurement Location	Time of Measurement	Measured Noise L <sub>Aeq(15min)</sub> dB(A)	Project Noise Level Trigger L <sub>Aeq(15min)</sub> dB(A)	Comments
Location 1 – Measurement Location to the east of the project site	March 2023 – Period when the building services were operational including condenser equipment	Measured noise level - 40 dB(A)	44 dB(A) L <sub>Aeq(15min)</sub>	Noise from the operation of the mechanical equipment was inaudible at this location.  Noise level generated from the operation of the building services compliant with relevant day and evening criteria.  See section below for further information
Location 2 – Measurement to the south of the project site		Measured noise level - 42 dB(A)	44 dB(A) L <sub>Aeq(15min)</sub>	Noise level generated from the operation of the building services compliant with relevant day and evening criteria.  The building services will not be required to run at maximum capacities during night time periods including the external condenser equipment  See section below for further information

## 4.1 Discussion

During testing the recorded noise level at the location to the east and south of the project site as detailed above, included environmental noise sources which were not associated with the operation of the school and included noise from traffic from- surrounding roadways and other environmental noise contributions.

Based on the results of testing, the contribution of the environmental noise sources has been corrected from the obtained site measurement such that the noise contributions from the operation of the school can be assessed as detailed in Table 1 above.

Based on the noise logging undertaken by Aurecon outlined in the (Aurecon Pendle Hill High School SSD Application – Acoustic Assessment Reference number 507914, Revision 3, table 4-1 (*Unattended noise monitoring results*)), the existing ambient  $L_{eq}$  noise levels at the site, prior to the development of the school are as follows:

**Table 4-1: Unattended noise monitoring results**

Location	Rating background noise level (RBL)			Average noise level						
	$dB(A)L_{90}(\text{period})$			$dB(A)L_{eq}(\text{period})$						
	Day	Evening	Night	Day	Evening	Night	Day (15hr)	Night (9hr)	Day (worst 1hr)	Night (worst 1hr)
UNML1	39	39	37	52	52	46	53	46	55	51
UNML2	40	40	36	53	52	48	53	48	56	51

Note 1: RBL is the median of the measured  $LA_{90}$  noise level during the day, evening and night-time periods of the monitoring programme.

Note 2: For the rating background and ambient noise levels, the periods are defined as per the NPI (EPA, 2017):

- Day: the period from 7.00 am to 6.00 pm Monday to Saturday or 8.00 am to 6.00 pm on Sundays and public holidays
- Evening: the period from 6.00 pm to 10.00 pm
- Night: the remaining periods.

For the 15-hour and 9-hour ambient noise levels, as per the Development Near Rail Corridors and Busy Roads – Interim Guideline (NSW DoP, 2008), day refers to the 7am to 10pm while night refers to 10pm to 7am.

Based on the results of the operational noise testing the  $L_{Aeq(15min)}$  noise levels have not increased as a result of the operation of the mechanical services of the school based on the above provided noise data.

Post completion mechanical operational compliance testing was conducted in the positions outlined in figure 1 of the report. These locations were selected as the mechanical plant serving the school is located to the south-eastern portion of the site as indicated in the below figure. Whilst onsite, attended noise measurements were also conducted at receiver locations 2 and 3 however the noise generated from the mechanical plant was completely inaudible at these receiver locations and was deemed irrelevant to our assessment.



Based on the results of acoustic testing noise levels resulting from the operation of the mechanical equipment on the site are compliant with the projects items E8 and E9 of the projects SSD 9579147 Conditions of Consent.

As exceedances have not been identified no additional noise mitigations are required.

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## 5 CONCLUSION

This report details the results of the post completion noise level testing conducted on the operational noise levels resulting from the mechanical system serving the completed Pendle Hill High School project.

Based on the results of acoustic testing noise levels resulting from the operation of the mechanical equipment on the site are compliant with E8 and E9 of the projects SSD 9579147 Conditions of Consent which includes reference to the Aurecon Pendle Hill High School SSD Application – Acoustic Assessment Reference number 507914, Revision 3.

In the event you require any additional information or clarification regarding this report please contact the undersigned.

Kind Regards,

A handwritten signature in blue ink, appearing to read 'G Kinezos', with a large, stylized initial 'G'.

George Kinezos  
Acoustic Engineer  
PULSE WHITE NOISE ACOUSTICS PTY LTD

## APPENDIX A. APPENDIX TERMINOLOGY

<i>Sound power level</i>	The total sound emitted by a source																						
<i>Sound pressure level</i>	The amount of sound at a specified point																						
<i>Decibel [dB]</i>	The measurement unit of sound																						
<i>A Weighted decibels [dB(A)]</i>	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).																						
<i>Decibel scale</i>	<p>The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows:</p> <table> <tr><td>0dB(A)</td><td>Threshold of human hearing</td></tr> <tr><td>30dB(A)</td><td>A quiet country park</td></tr> <tr><td>40dB(A)</td><td>Whisper in a library</td></tr> <tr><td>50dB(A)</td><td>Open office space</td></tr> <tr><td>70dB(A)</td><td>Inside a car on a freeway</td></tr> <tr><td>80dB(A)</td><td>Outboard motor</td></tr> <tr><td>90dB(A)</td><td>Heavy truck pass-by</td></tr> <tr><td>100dB(A)</td><td>Jackhammer/Subway train</td></tr> <tr><td>110 dB(A)</td><td>Rock Concert</td></tr> <tr><td>115dB(A)</td><td>Limit of sound permitted in industry</td></tr> <tr><td>120dB(A)</td><td>747 take off at 250 metres</td></tr> </table>	0dB(A)	Threshold of human hearing	30dB(A)	A quiet country park	40dB(A)	Whisper in a library	50dB(A)	Open office space	70dB(A)	Inside a car on a freeway	80dB(A)	Outboard motor	90dB(A)	Heavy truck pass-by	100dB(A)	Jackhammer/Subway train	110 dB(A)	Rock Concert	115dB(A)	Limit of sound permitted in industry	120dB(A)	747 take off at 250 metres
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<i>Frequency [f]</i>	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.																						
<i>Ambient sound</i>	The all-encompassing sound at a point composed of sound from all sources near and far.																						
<i>Equivalent continuous sound level [L<sub>eq</sub>]</i>	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.																						
<i>Reverberation</i>	The persistence of sound in a space after the source of that sound has been stopped (the reverberation time is the time taken for a reverberant sound field to decrease by 60 dB)																						
<i>Air-borne sound</i>	The sound emitted directly from a source into the surrounding air, such as speech, television or music																						
<i>Impact sound</i>	The sound emitted from force of one object hitting another such as footfalls and slamming cupboards.																						
<i>Air-borne sound isolation</i>	The reduction of airborne sound between two rooms.																						
<i>Sound Reduction Index [R] (Sound Transmission Loss)</i>	The ratio the sound incident on a partition to the sound transmitted by the partition.																						
<i>Weighted sound reduction index [R<sub>w</sub>]</i>	A single figure representation of the air-borne sound insulation of a partition based upon the R values for each frequency measured in a laboratory environment.																						
<i>Level difference [D]</i>	The difference in sound pressure level between two rooms.																						
<i>Normalised level difference [D<sub>n</sub>]</i>	The difference in sound pressure level between two rooms normalised for the absorption area of the receiving room.																						
<i>Standardised level difference [D<sub>nt</sub>]</i>	The difference in sound pressure level between two rooms normalised for the reverberation time of the receiving room.																						
<i>Weighted standardised level difference [D<sub>nt,w</sub>]</i>	A single figure representation of the air-borne sound insulation of a partition based upon the level difference. Generally used to present the performance of a partition when measured in situ on site.																						
<i>C<sub>tr</sub></i>	A value added to an R <sub>w</sub> or D <sub>nt,w</sub> value to account for variations in the spectrum.																						



<i>Impact sound isolation</i>	The resistance of a floor or wall to transmit impact sound.
<i>Impact sound pressure level <math>[L_i]</math></i>	The sound pressure level in the receiving room produced by impacts subjected to the adjacent floor or wall by a tapping machine.
<i>Normalised impact sound pressure level <math>[L_n]</math></i>	The impact sound pressure level normalised for the absorption area of the receiving room.
<i>Weighted normalised impact sound pressure level <math>[L_{n,w}]</math></i>	A single figure representation of the impact sound insulation of a floor or wall based upon the impact sound pressure level measured in a laboratory.
<i>Weighted standardised impact sound pressure level <math>[L'_{nT,w}]</math></i>	A single figure representation of the impact sound insulation of a floor or wall based upon the impact sound pressure level measured in situ on site.
$C_i$	A value added to an $L_{nW}$ or $L'_{nT,w}$ value to account for variations in the spectrum.
<i>Energy Equivalent Sound Pressure Level <math>[L_{A,eq,T}]</math></i>	'A' weighted, energy averaged sound pressure level over the measurement period T.
<i>Percentile Sound Pressure Level <math>[L_{Ax,T}]</math></i>	'A' weighted, sound pressure that is exceeded for percentile x of the measurement period T.
<i>Speech Privacy</i>	A non-technical term but one of common usage. Speech privacy and speech intelligibility are opposites and a high level of speech privacy means a low level of speech intelligibility. It should be recognised that acceptable levels of speech privacy do not require that speech from an adjacent room is inaudible.
<i>Sound Pressure Level, <math>L_p</math> dB</i>	A measurement obtained directly using a microphone and sound level meter. Sound pressure level varies with distance from a source and with changes to the measuring environment. Sound pressure level equals 20 times the logarithm to the base 10 of the ratio of the rms sound pressure to the reference sound pressure of 20 micro Pascals.
<i>Sound Power Level, <math>L_w</math> dB</i>	Sound power level is a measure of the sound energy emitted by a source, does not change with distance, and cannot be directly measured. Sound power level of a machine may vary depending on the actual operating load and is calculated from sound pressure level measurements with appropriate corrections for distance and/or environmental conditions. Sound power levels is equal to 10 times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 picoWatt
<i>Noise Reduction</i>	The difference in sound pressure level between any two areas. The term "noise reduction" does not specify any grade or performance quality unless accompanied by a specification of the units and conditions under which the units shall apply
<i>Audible Range</i>	The limits of frequency which are audible or heard as sound. The normal ear in young adults detects sound having frequencies in the region 20 Hz to 20 kHz, although it is possible for some people to detect frequencies outside these limits.
<i>Background Sound Low</i>	The average of the lowest levels of the sound levels measured in an affected area in the absence of noise from occupants and from unwanted, external ambient noise sources. Usually taken to mean the LA90 value
<i>Character, acoustic</i>	The total of the qualities making up the individuality of the noise. The pitch or shape of a sound's frequency content (spectrum) dictate a sound's character.
<i>Loudness</i>	A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on
$L_{Max}$	The maximum sound pressure level measured over a given period.
$L_{Min}$	The minimum sound pressure level measured over a given period.
$L_1$	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
$L_{10}$	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
$L_{90}$	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
$L_{eq}$	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.