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Project 3821
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The Acoustic Box Pty Ltd
Attention: Mr Simon Samaan
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Dear Simon

VENTILATED ACOUSTIC ENCLOSURE – NOISE EMISSION ASSESSMENT
ACOUSTIC SERVICES & ADVICE

1 INTRODUCTION

Acoustic Dynamics is engaged by The Acoustic Box Pty Ltd to assess the reduction in noise emission resulting from the use and operation of a mechanical (electrical) pool pump, when housed within a ventilated acoustic enclosure “Acousticbox”.

This document provides the results of a site visit, noise measurements, an assessment of the reduction in noise emission level resulting from use/incorporation of an acoustic enclosure placed around pool mechanical equipment.

This document is prepared in accordance with the reporting requirements of our client along with relevant ISO and Australian Standards, and provides an assessment of sound reduction performance of the acoustic enclosure.

2 NOISE DESCRIPTORS AND DEFINITIONS

2.1 Noise

Noise is the presence of unwanted sound. The sound is produced through rapid variations in air pressure at audible frequencies (20 Hz – 20 kHz). Most noise sources vary with time. The measurement of a variable noise source requires the ability to describe the sound over a particular duration of time. A series of industry standard statistical descriptors have been developed to describe variable noise, as outlined in Section 2.1.2 below.

2..2 Noise Descriptors

L_{Aeq} – The A-weighted equivalent continuous level which is a measure of the energy content of a sound over a time period. It gives a single figure expressing the equivalent of a varying level. It can be considered to be the “average” sound level.

L_{A90} – The A-weighted noise level exceeded for 90% of the sample time.

2.3 A-weighting

"A-weighting" refers to a prescribed amplitude versus frequency curve used to "weight" noise measurements in order to represent the frequency response of the human ear. Simply, the human ear is less sensitive to noise at some frequencies and more sensitive to noise at other frequencies. The A-weighting is a method to present a measurement or calculation result with a number representing how humans subjectively hear different frequencies at different levels.

2.4 Noise Character, Noise level and Annoyance

The perception of a given sound to be deemed annoying or acceptable is greatly influenced by the character of the sound and how it contrasts with the character of the background noise. A noise source may be measured to have only a marginal difference to the background noise level, but may be perceived as annoying due to the character of the noise.

Acoustic Dynamics' analysis of noise considers both the noise level and sound character in the assessment of annoyance and impact on amenity.

3 RELEVANT ACOUSTIC CRITERIA

3.1 NSW Protection of the Environment Operations Act 1997

Acoustic Dynamics advises that noise emission within any Local Government area must not generate "offensive noise", as defined within the NSW Protection of the Environment Operations (POEO) Act 1997. Within the POEO Act 1997, "offensive noise" is defined as follows:

> *"**"offensive noise"** means noise:*
>
> *(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:*
>
> *(i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or*
>
> *(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted,*
>
> *or*
>
> *(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances, prescribed by the regulations."*

3.2 NSW Protection of the Environment Operations (Noise Control) Regulation 2008

Acoustic Dynamics advises that noise emission resulting from the operation of residential pool equipment within NSW must comply with the requirements of the NSW Protection of the Environment Operations (POEO) (Noise Control) Regulation 2008. Within the POEO Regulation 2008, the following requirements are specified:

> ***"Subdivision 1 Time limits on the use of certain articles***
>
> ***50 Power tools and equipment***
>
> *(1) A person must not cause or permit a power tool or swimming pool pump to be used on residential premises in such a manner that it emits noise that can be heard within a habitable room in any other residential premises (regardless of whether any door or window to that room is open):*
>
> *(a) before 8 am or after 8 pm on any Sunday or public holiday, or*
> *(b) before 7 am or after 8 pm on any other day.*
>
> *(3) In this clause:*
> ***swimming pool pump** includes a spa pump.*
>
> ***52 Air conditioners and heat pump water heaters***
>
> *(1) A person must not cause or permit an air conditioner or heat pump water heater to be used on residential premises in such a manner that it emits noise that can be heard within a habitable room in any other residential premises (regardless of whether any door or window to that room is open):*
>
> *(a) before 8 am or after 10 pm on any Saturday, Sunday or public holiday, or*
> *(b) before 7 am or after 10 pm on any other day.*
>
> *(4) In this clause:*
> ***heat pump water heater** means a device that heats water using the energy generated from the compression of a gas."*

3.3 Government Legislation

In addition to the above, within NSW and throughout Australia, Local Governments regulate noise emission resulting from the operation of pool equipment under the above planning controls, and via their LEP, DCP and other planning controls and guidelines.

The NSW EPA's Noise Guide for Local Government (NGLG) includes guidance on the assessment of mechanical noise sources, such as pool equipment. Within this guidance, the EPA recommends the use of the intrusive criterion, also represented by background (L_{A90}) noise level plus 5 dB.

Councils can enforce the above planning controls under the Environmental Planning and Assessment Act of 1979.

4 NOISE MEASUREMENT EQUIPMENT & STANDARDS

All measurements were conducted in general accordance with Australian Standard 1055.1-1997, *"Acoustics - Description and Measurement of Environmental Noise Part 1: General Procedures"*. Acoustic Dynamics' sound measurements were carried out using precision sound level meters conforming to the requirements of IEC 61672-2002 *"Electroacoustics: Sound Level Meters – Part 1: Specifications"*. The survey instrumentation used during the survey is set out in **Table 4.1**.

Table 4.1 Noise Survey Instrumentation

Type	Serial Number	Instrument Description
2270	2664115	Brüel & Kjaer Modular Precision Sound Level Meter
4189	2385698	Brüel & Kjaer 12.5 mm Prepolarised Condenser Microphone
4230	623588	Brüel & Kjaer Acoustic Calibrator

The reference sound pressure level was checked prior to and after the measurements using the acoustic calibrator and remained within acceptable limits.

5 NOISE MEASUREMENTS PROCEDURE

Noise emission measurements were taken within the backyard of 75 First Avenue, Five Dock, between 3:15pm and 4:30pm on Tuesday 19 April 2016.

The weather conditions during the noise measurement surveys were calm, and did not affect the measurement results. To quantify the maximum likely noise emission reduction from the acoustic enclosure during normal operation, the following mechanical plant and generated noise source were used:

- AstraPool Australia E-series 170 Pool Pump; and
- Generated Pink Noise (via loudspeaker).

Photo 5.1 "Acousticbox"

Field noise measurements were taken at a central position at the front, sides, rear and above the acoustic enclosure at a distance of one (1) metre from the equipment. Measurements were conducted with and without the enclosure in place at a height of approximately 1.2 metres. The pool pump was placed on the lawn (grass) and the acoustic enclosure was erected around the pump sitting on a light wooden frame. Background ambient noise measurements were taken prior to the operation of the pool pump to ensure influence of this did not affect the measurement results.

The testing conditions were not ideal, with the pool pump and the acoustic enclosure both placed on the grass, not a solid (e.g. concrete) surface. The enclosure was not fastened to the ground and air-gaps were present under the lightweight enclosure frame and at some of the joints of the enclosure.

6 MEASUREMENT RESULTS

The noise level average (L_{Aeq}) emission at one (1) metre around the pool pump without the acoustic enclosure was 68 dB (an L_{Aeq} sound power level (SWL) of 76 dB).

With the acoustic enclosure fitted around the pool pump the L_{Aeq} was reduced to 49 dB at one (1) metre. This gives an overall 'A' weighted noise reduction of 19 dB.

As indicated above, there were a number of noise leakage points during the measurements, via the timber frame, and within the corners of the enclosure which would contribute to the noise emissions measurement. Therefore it is likely that the reduction the enclosure would perform marginally better under ideal testing conditions or for an actual installation, assuming the enclosure is well sealed.

Figure 6.1 below shows the overall 'A' weighted noise levels and the 1/3 octave band frequency noise levels of the pool pump without the enclosure and with the enclosure at a distance of one (1) metre, and **Figure 6.2** shows the 1/3 octave band noise level reduction achieved by the acoustic enclosure at a distance of one (1) metre.

Figure 6.1 Overall A-Weighted & 1/3 Octave Band Noise Levels - Pool Pump With and Without Acoustic Enclosure

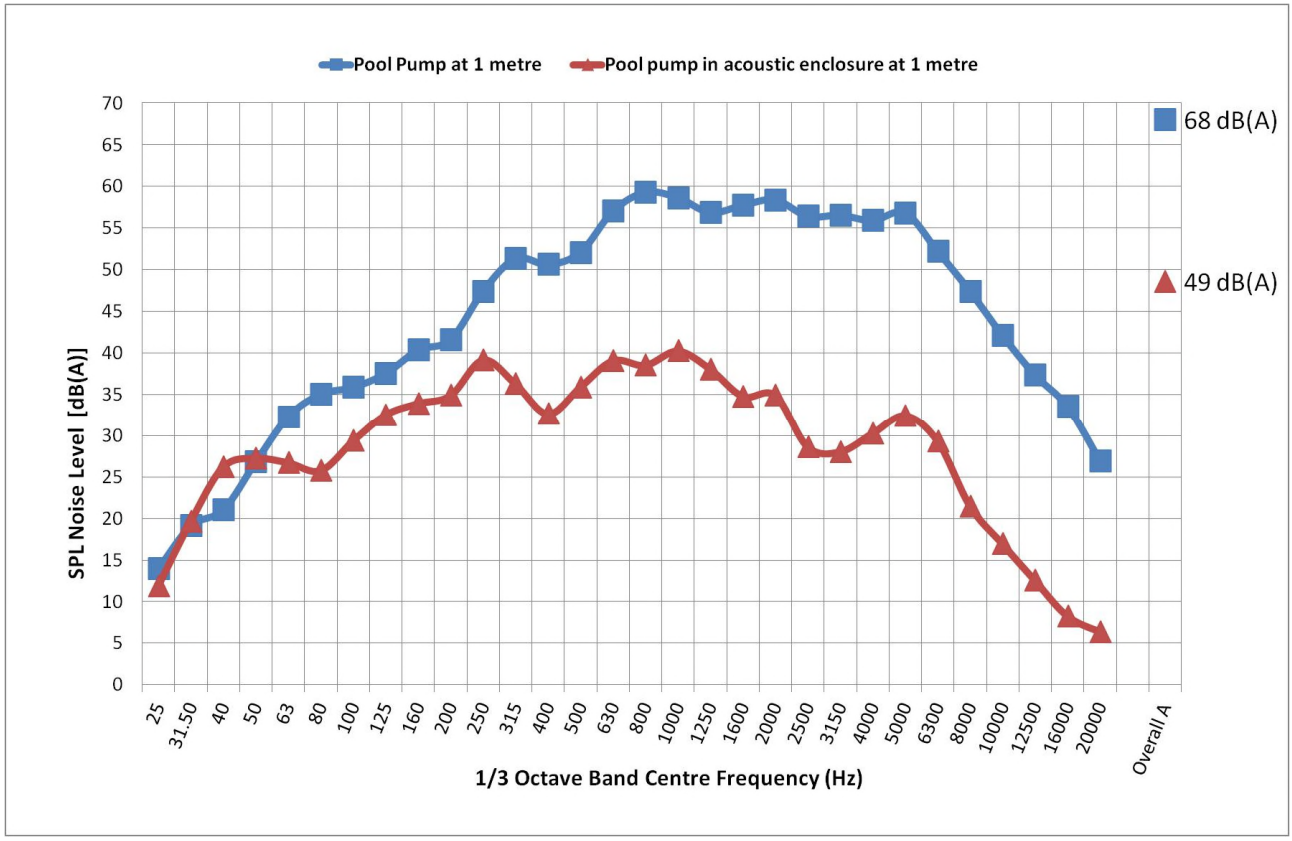


Figure 6.2 Reduction in 1/3 Octave Band Pool Pump Noise Levels Achieved by Acoustic Enclosure

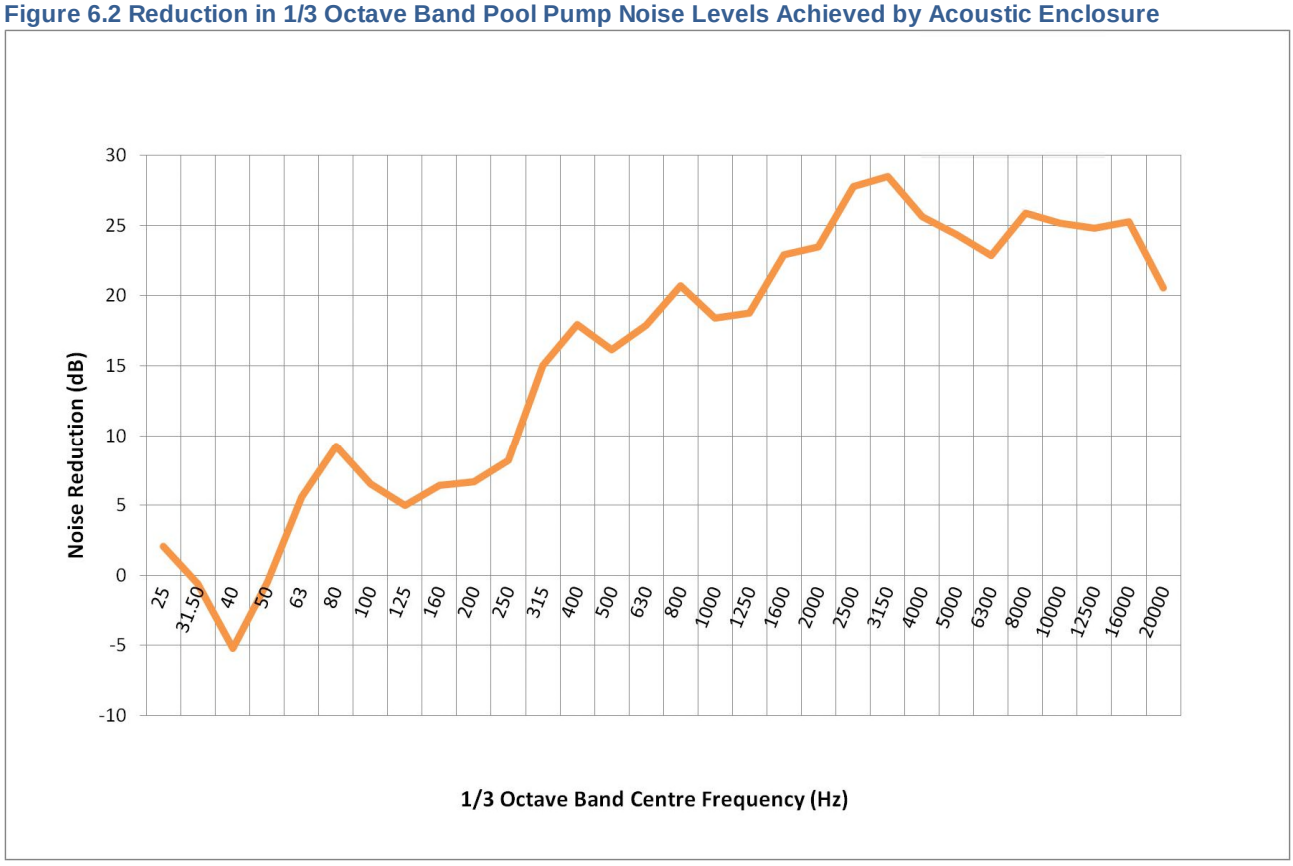


Table 6.1 Measured Octave Band Noise Reduction

	Octave Band Centre Frequency (Hz)										O/All
	31	63	125	250	500	1k	2k	4k	8k	16k	(A-Wgt)
Noise Reduction	0[1]	6	5	8	16	18	23	26	26	25	19[2]

Note: 1) Controlled by higher measured background noise level
2) Measured difference between overall A-weighted noise source and background level

7 CONCLUSION

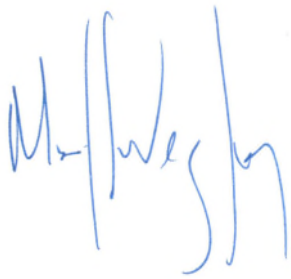
Acoustic Dynamics has conducted an acoustic assessment of the noise emission reduction associated with an acoustic enclosure "Acousticbox", for use with pool pumps and pool equipment.

The L_{Aeq} emission at one (1) metre around the pool pump without the acoustic enclosure was **68 dB**. With the acoustic enclosure fitted the L_{Aeq} noise emission level reduced to **49 dB** at a distance of one (1) metre. This gives an overall A-weighted noise reduction of **19 dB**.

The testing conditions were not ideal, and as such, a marginally greater reduction in noise emission levels is likely to be achieved for an actual installation, assuming the enclosure is well sealed.

We trust that the above information meets with your requirements and expectations. Please do not hesitate to contact us on 02 9908 1270 should you require our services further.

Kind Regards
ACOUSTIC DYNAMICS



MATTHEW WESTON

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