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ACOUSTICAL REPORT

SOUND BUNKER POOL PUMP ENCLOSURES

6/16 RELIANCE DRIVE, TUGGERAH NSW

Date: Monday, 19th December 2022

File Reference: 4762R20221216mjSoundBunkerPoolPumpEnclosures.docx

DOCUMENT CONTROL

Project title	Acoustical Report Pool Pump Enclosure Noise Reduction Measurements Sound Bunker Pool Pump Enclosures 6/16 Reliance Drive, Tuggerah NSW
Project number	4762
Document reference	4762R20221216mjSoundBunkerPoolPumpEnclosures.docx
Document path	G:\Shared drives\KA Acoustics 2022\REPORT\Mechanical Plant\4762 (mj) Sound Bunker Pool Pump Enclosures\4762R20221216mjSoundBunkerPoolPumpEnclosures.docx

Version	Date	Author	Review	Notes
V1	19/12/2022	MJ	NK	Report version 1 available for issue

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ACOUSTICAL REPORT

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6/16 RELIANCE DRIVE, TUGGERAH NSW

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1.0 INTRODUCTION

Koikas Acoustics was requested by Sound Bunker Pty Ltd to measure the noise reduction of two prototype commercial pool pump enclosures. Noise measurements were conducted under controlled testing conditions to determine the noise reduction of the “ECO Defend” and “ECO Secure” enclosure sections.

This report outlines the measured noise reduction of the pool pump enclosures under a variety of conditions utilising different levels of absorptive material within the pool pump enclosure. The effective noise reduction of the enclosures is also presented in this report.

2.0 NOISE REDUCTION MEASUREMENT METHOD

2.1 GENERATION OF SOUND FIELD WITHIN THE ENCLOSURE – ECO SECURE

The sound field was generated with a dodecahedron loudspeaker powered by a Behringer Ultragain Pro MIC2200 pre-amplifier and a Behringer Europower EP4000 power amplifier. A pink noise signal was provided by an NTi Audio Minirator MR2 Pro.

The source noise level was measured with an NTi Audio XL2 spectrum analyser sound level meter placed inside the enclosure.

2.2 GENERATION OF SOUND FIELD WITHIN THE ENCLOSURE – ECO DEFEND

The sound field was generated with a Sony Bluetooth loudspeaker. A pink noise signal was provided by a Noise Generator iPhone app. This method was utilised for this pump enclosure due to the enclosure's size compared to Koikas Acoustics dodecahedron loudspeakers. The source noise level was measured with an NTi Audio XL2 spectrum analyser sound level meter placed inside the enclosure.

2.3 CORRECTIONS FOR A POOL PUMP SPECTRUM

The source noise level within the enclosure was then corrected to equate the expected spectrum of a pool pump. The spectrum of the pool pump was taken for measurements previously conducted by Koikas Acoustics of a Viron P320 Evo Pool Pump.

2.4 NOISE MEASUREMENTS OUTSIDE THE ENCLOSURE

Noise level measurements outside the enclosure were measured using an NTi Audio XL2 spectrum analyser sound level metre. Noise measurements were spatially averaged across the length of the enclosure at 2 m from the enclosure. Measurements were conducted in 1/3 octave bands with a fast-time weight response. Noise measurements were taken in four directions from the enclosure (*Front, rear and the two sides*). These measurements were then logarithmically averaged to provide a total effective noise reduction of pool pump noise through the enclosure. The sound measuring instrument carries NATA-certification calibrations.

Calibration measurements were taken before and after the measurements with a calibrated pistonphone that also carries NATA calibration certification. No system drift was observed for the NTi XL2 instrument.

2.5 INTERNAL ABSORPTIVE LINING

Noise measurements were taken without the enclosure and then, sound absorptive insulation was systematically added to at least one opposite wall of the enclosures.

50 mm thick, 48 kg/m^3 polyester insulation batt was installed internally to the rear and side wall and the underside of the ECO Secure openable top panel.

25 mm thick, 48 kg/m^3 polyester insulation batt was installed internally to the rear and side walls of ECO Defend.

3.0 MEASUREMENT RESULTS

The results of the acoustic tests (*sound levels normalised for an Evo pool pump*) are tabulated below.

3.1 ECO SECURE ENCLOSURE

Table 1. Measured Noise Reduction of ECO Secure Sound Bunker Enclosure, LAeq, Period [dB]

Measurement	Enclosure Configuration	Sound pressure level outside enclosure	Effective Noise reduction (dB)
Noise Level @ 2 m	No Enclosure	**108**	-
Front	No Insulation	95	13
Side 1		92	16
Rear		92	16
Side 2		91	17
Log Average		93	**16**
Front	Rear Wall Insulated	90	18
Side 1		86	22
Rear		86	22
Side 2		86	22
Log Average		88	**21**
Front	Side and Rear Wall Insulated	89	19
Side 1		85	23
Rear		84	24
Side 2		84	24
Log Average		86	**23**
Front	Side Wall, Rear Wall and Ceiling Insulated	87	21
Side 1		82	26
Rear		82	26
Side 2		82	26
Log Average		84	**25**

3.2 ECO DEFEND ENCLOSURE

Table 2. Measured Noise Reduction of ECO Defend Sound Bunker Enclosure, LAeq, Period [dB]			
Measurement	**Enclosure Configuration**	**Sound pressure level outside enclosure**	**Effective Noise reduction (dB)**
Noise Level Inside @ 2 m	No Enclosure	**90**	-
Front	No Insulation	73	17
Side 1		73	17
Rear		71	19
Side 2		72	18
Log Average		**74**	**16**
Front	Rear Wall Insulated	72	18
Side 1		74	16
Rear		71	19
Side 2		72	18
Log Average		**73**	**17**
Front	Side and Rear Wall Insulated	72	18
Side 1		72	18
Rear		72	18
Side 2		72	18
Log Average		**72**	**18**

4.0 CONCLUSIONS

Koikas Acoustics was requested to conduct an acoustical assessment of noise reduction through two pool pump enclosures as made by Sound Bunker Pty Ltd. This assessment considers the effective noise reduction of pool pump noise through an enclosure with various surface areas covered with absorptive insulation.

Noise level measurements were taken in four directions surrounding each pool pump enclosure and logarithmically averaged to provide a total effective noise reduction of the enclosure.

For the ECO Secure Sound Bunker, the addition of sound-absorbing insulation resulted in a significant reduction in noise for the low, middle, and to a lesser extent the higher frequencies on account of the large side openings.

For the ECO Defend Sound Bunker, the addition of sound-absorbing insulation resulted in a significant and noticeable reduction in high-frequency noise. The panels on the ECO Defend Sound Bunker would need to be cut with greater precision to reduce sound leakages.

Both Sound Bunkers have achieved, even without the addition of internally lined insulation, a significant noise reduction that is greater than in comparison to the use of partial noise barriers.

It is the opinion of Koikas Acoustics, that if the openings in the enclosures were minimised, the noise reduction would be further improved.

The following is a list of how different levels of noise reduction are perceived by humans with normal hearing:

A noise reduction of 10 dB is perceived as being 1/2 as loud.
A noise reduction of 16 dB is perceived as being 1/3 as loud.
A noise reduction of 20 dB is perceived as being 1/4 as loud.
A noise reduction of 25 dB is perceived as being 1/5 as loud.