Sound Test Results: Green e-Pack & Thermboil

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1. LEGAL FRAMEWORK

The sound test was made according to the Class A methodology described in EN12102. This law is referred to ISO3747:2010 *Acoustics. Determination of sound power levels and sound energy levels of noise sources using sound pressure. Engineering/survey methods for use in situ in a reverberant environment.*

The instructions described in ISO3757:2010 have been followed to measure and calculate the sound power levels of noise for both Green e-Pack and Thermboil, in the conditions according to EN16147.

2. NOISE SOURCE

a) Description

A1) Thermboil: The Thermboil is a water heater which consists on a heat pump in which the evaporator is a thermodynamic panel directly exposed to the sun. The noisy part of the system is the compressor which is located above the cylinder.

B1) Green e-Pack: Is a compact heat pump which includes a heat exchanger to heat the water from an existing cylinder. The noisy elements inside the box are the compressor and the hydraulic pump, used to recirculate water from/to the cylinder.

b) Conditions

The settings and test conditions are those described in EN 16147:2011 for both Thermboil and Green e-Pack. The water outlet temperature set point is 55ºC.

c) Mounting

C1) Thermboil: A TB200E is mounted close to the wall

C2) Green e-Pack: It is mounted screw to the wall 0.5 m height connected to a 200L cylinder.

3. TESTING

a) Building

The test was made in the Factory Building. It is a nave 12m height x 43m depth x 63m lenght, built in cement.

b) Instrumentation

Instrument:PCE-322 A

b) Acoustic Data

- **Test**

It was measured the background sound level (when the system doesn't work) and the noise level of the each system working in the following conditions:

The settings and test conditions shall be the same as the thermal performance tests (see Table 5 EN 16147:2011). The water outlet temperature set point shall be set to maximum (55ºC).

The first sound measurement (T0) shall be carried out immediately after a draw-off, providing the water outlet temperature has reached 45°C ±2°C .

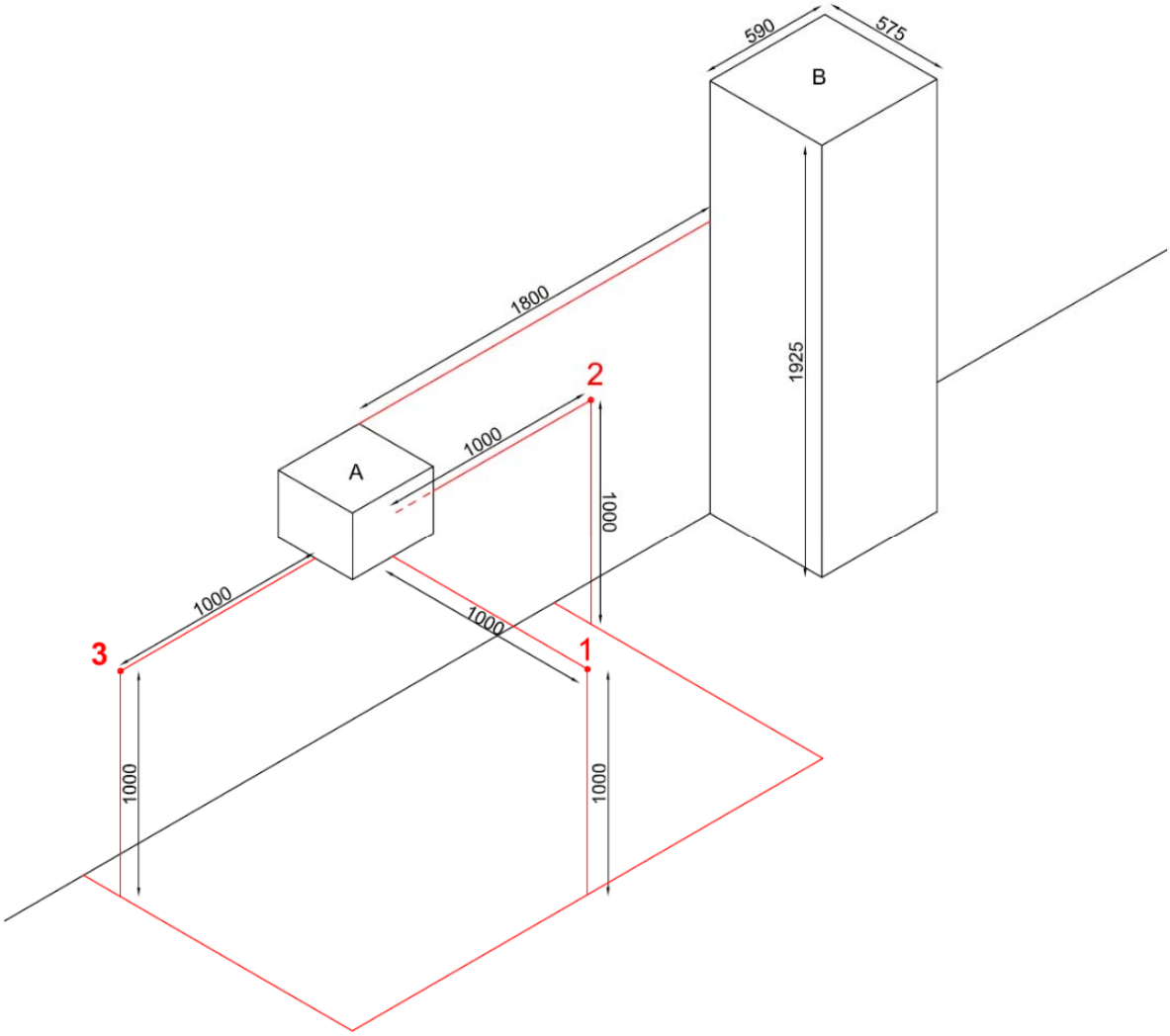
A second draw-off followed by a sound measurement shall be carried out 10 minutes after T0, and shall be repeated every 10 minutes thereafter.

The final sound measurement shall be carried out after 30 minutes have elapsed, or if the water outlet temperature reaches 55°C ±2°C.

- **Green e-Pack:**

In the Figure 1 is shown a drawing of the Green e-Pack (A) connected to a storage cylinder (B). The microphone locations are called 1,2 and 3. These locations are located a meter away from the middle part of each lateral of the box, at one meter height.

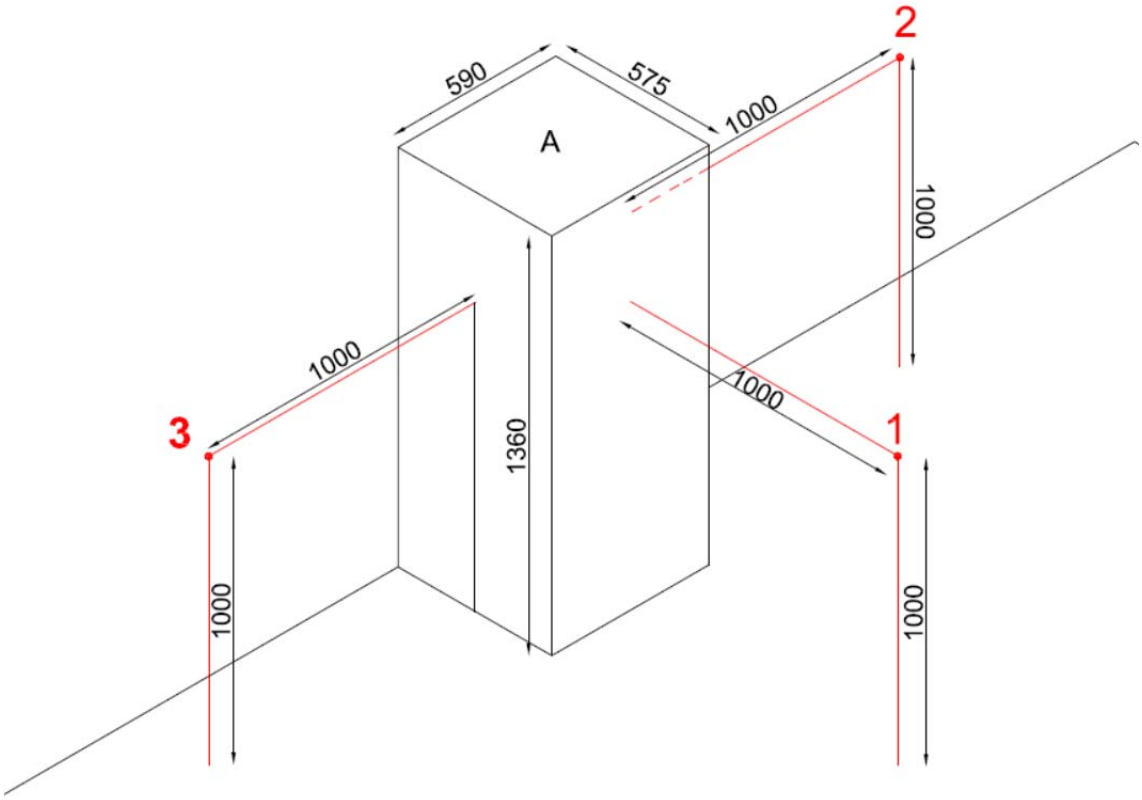
Figure 1. Microphone locations for the Green e-Pack



- **Thermboil**

In the Figure 1 is shown a drawing of the Thermboil (A) The microphone locations are called 1, 2 and 3. These locations are located a meter away from the middle part of each lateral of the system, at one meter height.

Figure 2. Microphone locations for the Thermboil



c) Results

The average power sound is calculated by the following expression:

$$\overline{L_{p(ST)}} = 10 \lg \left[\frac{1}{n} \sum_{i=1}^{n} 10^{0,1 L_{pi(ST)}} \right] dB$$

Green e-Pack						
Time min,	Location	Source Noise dBA	Background Noise dBA	ΔLpi, dBA	Correction, K_{li}	$10^{0,1Lpi}$
0	1	32	24	8	0,749403674	1333,70
0	2	36,1	24	12,1	0,276395386	3822,61
0	3	38	24,1	13,9	0,180627718	6052,53
Average Power Noise: First Sound Measurement, dBA						**35,72**
10	1	31,3	23,9	7,4	0,872308145	1103,491991
10	2	34,9	24	10,9	0,368182717	2839,106789
10	3	36,9	24,2	12,7	0,239726192	4634,761394
Average Power Noise Second Sound Measurement, dBA						**34,56**
20	1	31,2	24	7,2	0,91807865	1067,068095
20	2	33,8	23,9	9,9	0,468829496	2153,362027
20	3	36,4	24,1	12,3	0,263570117	4108,118744
Average Power Noise Third Sound Measurement, dBA						**33,88**
30	1	31	24	7	0,966528953	1007,736769
30	2	33,6	24	9,6	0,504381734	2039,67901
30	3	36,4	24,1	12,3	0,263570117	4108,118744
Average Power Noise Final Sound Measurement, dBA						**33,78**

Power noise Level Green e-Pack: 35.7 dBA (the maximum)

Thermboil						
Time min,	**Position**	**Source Noise dBA**	**Background Noise dBA**	**ΔLpi, dBA**	**Correction, K_{li}**	**$10^{0,1Lpi}$**
0	1	31,8	23,9	7,9	0,768498	1268,09
0	2	32	23,6	8,4	0,678023117	1355,81
0	3	31,7	23,9	7,8	0,788124386	1233,64
Average Power Noise: First Sound Measurement, dBA						**31,09**
10	1	31,5	23,9	7,6	0,8290434	1167,06665
10	2	31,6	23,8	7,8	0,788124386	1205,55648
10	3	31	23,8	7,2	0,91807865	1019,04212
Average Power Noise Second Sound Measurement, dBA						**30,53**
20	1	31,3	23,2	8,1	0,730824745	1140,03327
20	2	31,5	24	7,5	0,850372865	1161,3489
20	3	31	24,1	6,9	0,991817642	1001,88583
Average Power Noise Third Sound Measurement, dBA						**30,42**
30	1	31,2	23,8	7,4	0,872308145	1078,37345
30	2	31,4	24,1	7,3	0,894869647	1123,34469
30	3	31,1	24,1	7	0,966528953	1031,20997
Average Power Noise Final Sound Measurement, dBA						**30,32**

Power noise Level Thermboil: 31.1 dBA (the maximum)

4. CONCLUSIONS

The sound level in both systems varies depending on the water temperature (condensing pressure). When the water temperature is higher both systems work at higher condensing pressure (on the high pressure side), increasing the noise of the compressor.