

17th July 2015

FAO Dominic Cooney Less CO2 Ltd High Up Farm High Up Lane Leek ST13 8SD

Dear Dominic,

DC1849-L1, Proposal for Change of Candidate Turbine

Further to our telephone discussion please find below our written statement detailing comparative noise levels for the 'Endurance E3120' 50kW turbine and the 'Endurance E4660' 85kW turbine.

Sound Power levels (L_W) for the 'Endurance E3120' have been taken from the document "*Endurance E-3120* Wind Turbine Acoustic Performance Test" technical report (Ref: HM:2300/R1) produced by Hayes McKenzie Partnership (Dated: 06/04/2011). This document details the inclusion of the addition of an uncertainty value of +1.6dB to all sound power levels.

The published noise data for this turbine has been reviewed with reference to the guidance detailed in the Institute of Acoustics document 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise'.

The third octave band data for this turbine is not considered suitable for undertaking an assessment using ISO9613-2, Equation (9), as the provided third octave band data is not available for all necessary wind speeds. All recommendations from Section 4.3 of the Good Practice Guide have been followed.

Wind Sneed (m/s)	Δ	5	6	7	8	9	10
	-	5	Ū	,	0	5	10
Sound Power Level (dBA)	87.3	87.6	89.7	89.0	90.6	92.4	94.3
Uncertainty (ULWA,k)	1.60	1.60	1.60	1.60	1.60	1.60	1.60
Uncertainty (U _{LWA,k}) at 95% Confidence Level*	1.60	1.60	1.60	1.60	1.60	1.60	1.60

Table 1	
Endurance E3120' Calculated Sound Power Levels, Broadband (d	B)

*As the Hayes Mackenzie Data has been deemed suitable in terms of uncertainty, and has remained unchallenged for a number of years, the uncertainty value used in the calculation process is that which is specified by Hayes Mackenzie, rather than the standard calculation used for "Uncertainty at 95% Confidence Level".



www.dragonfly-consulting.com

Tel: 01904 898368 E-mail: info@dragonfly-consulting.com

Dragonfly Acoustics Ltd. - Company No. 6453657 VAT No. 933019052 Unit 4 Abbey Court, Benedict Drive, Selby, YO8 8RY



The noise data for the 'Endurance E4660' has been taken from the document "*Endurance E4660 Wind Turbine, Wind Turbine Performance Assessment*" technical report (Ref: DC1633-R1v6) produced by Dragonfly Consulting (Dated: February 2015). This report is approved by the manufacturer, but is not currently warranted.

The published noise data for this turbine has been reviewed with reference to the guidance detailed in the Institute of Acoustics document 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise'.

The third octave band data for this turbine is considered suitable for undertaking an assessment using ISO9613-2, Equation (9). All recommendations from Section 4.3 of the Good Practice Guide have been followed and, as the data is not warranted, the uncertainty corrections have been included following the guidance in the IOA Good Practice Guide, multiplying the manufacturers stated uncertainty value by 1.645 to produce an uncertainty correction to a 95% confidence level.

Frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Sound Power Level (dBA) @4m/s	62.5	70.3	80.4	79.8	81.7	76.2	65.6	55.3
Sound Power Level (dBA) @5m/s	62.4	71.3	81.4	80.8	81.5	76.1	66.1	54.9
Sound Power Level (dBA) @6m/s	63.5	72.1	82.0	81.3	81.4	76.5	67.2	57.1
Sound Power Level (dBA) @7m/s	65.5	73.3	82.2	81.7	81.1	76.4	68.9	59.8
Sound Power Level (dBA) @8m/s	67.4	75.1	83.1	82.3	81.3	77.3	71.7	64.6
Sound Power Level (dBA) @9m/s	70.0	77.1	84.2	83.3	82.0	78.8	74.6	68.4
Sound Power Level (dBA) @10m/s	69.3	77.4	84.4	83.3	82.2	79.4	75.6	69.0
Uncertainty (ULWA,k)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Uncertainty (U _{LWA,k}) at 95% Confidence Level	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48

Table 2'Endurance E4660' Calculated Sound Power Levels, 1/3 Octave Band (dB)

Represented as broadband values, the calculated Sound Power Levels for the 'Endurance E4660' are as follows:

Tel: 01904 898368 | E-mail: info@dragonfly-consulting.com Dragonfly Acoustics Ltd. - Company No. 6453657 |VAT No. 933019052 | Unit 4 Abbey Court, Benedict Drive, Selby, YO8 8RY



 Table 3

 'Endurance E4660' Calculated Sound Power Levels, Broadband (dB)

Wind Speed (m/s)	4	5	6	7	8	9	10
Sound Power Level (dBA)	86.1	86.6	87.0	87.2	87.9	89.1	89.3
Uncertainty (U _{LWA,k})	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Uncertainty (U _{LWA,k}) at 95% Confidence Level	1.48	1.48	1.48	1.48	1.48	1.48	1.48

A comparison of the two turbines in question, including uncertainty, can be seen in Table 4 below:

Table 4
Comparison of Sound Power Levels, Including Uncertainty (dB)

Wind Speed (m/s)	4	5	6	7	8	9	10
Sound Power Level of Endurance E3120 (dBA)	88.9	89.2	91.3	90.6	92.2	94.0	95.9
Sound Power Level of Endurance E4660 (dBA)	87.6	88.1	88.5	88.7	89.4	90.6	90.8
Difference (dB)	-1.3	-1.1	-2.8	-1.9	-2.8	-3.4	-5.1

The data in Table 4 shows that the sound power levels for the 'Endurance E4660' are lower than those for the 'Endurance E3120' wind turbine at all available assessed wind speeds. On this basis the noise levels for the E4660 measured at the same distance from the turbine will be lower than those for the E3120. In layman's terms this means the E4660 is a 'quieter' turbine than the E3120.

If you have any further queries or require further information, please do not hesitate to contact me.

Yours sincerely,

Graeme Parker, BSc (Hons), DipANC, AMIOA Operations Director For and on behalf of Dragonfly Consulting

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