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Product Certification

Evance R9000 UK MCS Certification Summary

Issue 03



Certificate Number MCS WT0039
Small Wind Turbine



BWEA small wind turbine
standard, 2008

Certified by
BRE

Reference
Annual
Energy **8,780** kWh

Annual average wind speed of 5 m/s (11 mph). Your performance may vary

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1. Introduction

This document summarises the results of UK MCS product certification conducted on an Evance R9000 wind turbine. Tests were carried out in accordance with MCS 006¹ & MCS 011² which subsequently reference BWEA Feb 08³ and British Standards - 61400-2⁴, 61400-11⁵ and 61400-12⁶.

All measurements were undertaken at two certified test sites located in Pendeen, Cornwall and Hoswick, Shetland.

2. Power Curve

Table 1 and Table 2 show the power performance results at sea level air density for the Evance R9000.

BWEA Reference Power (Watts)	4628
Cut-in Wind Speed (m/s)	3
Maximum Power (Watts)	5296

TABLE 1 - BWEA DEFINITION RESULTS

Measured power curve							
Reference air density: 1.225kg/m ³					Category A	Category B	Combined uncertainty
Bin no.	Hub height wind speed m/s	Power output Watts	C _p	No. of data sets 1 min. Avg.	Standard uncertainty S _i Watts	Standard uncertainty U _i Watts	Standard uncertainty U _{ci} Watts
1	0.55	3	1.02	134	1	18	18
2	1.02	2	0.14	330	0	18	18
3	1.54	1	0.03	689	0	18	18
4	2.01	1	0.01	1207	0	18	18
5	2.51	-4	-0.02	1988	0	18	18
6	3.01	14	0.03	2620	1	20	20
7	3.51	83	0.13	3667	1	40	40
8	4.00	210	0.23	4251	2	70	70
9	4.50	376	0.28	4671	2	90	90
10	5.00	576	0.32	4456	2	111	111
11	5.50	820	0.34	4211	3	136	136
12	6.00	1104	0.35	4157	4	163	163
13	6.50	1416	0.35	4009	5	182	182
14	7.00	1783	0.36	3980	6	219	219
15	7.50	2151	0.35	4051	6	224	224
16	7.99	2542	0.34	3787	7	244	244
17	8.49	2951	0.33	3509	8	260	260
18	8.99	3349	0.32	3075	9	257	257
19	9.49	3721	0.30	2500	9	248	248
20	9.98	4077	0.28	1936	10	246	246
21	10.48	4394	0.26	1446	10	220	220
22	10.99	4628	0.24	1058	11	166	166
23	11.48	4806	0.22	771	12	134	135
24	11.99	4911	0.20	623	10	85	86
25	12.49	5017	0.18	525	8	88	89
26	12.98	5066	0.16	361	8	56	57
27	13.50	5109	0.14	286	8	53	53
28	13.97	5141	0.13	215	8	49	50
29	14.52	5151	0.12	148	10	42	44

30	14.99	5142	0.10	128	12	43	44
31	15.49	5122	0.09	88	24	45	51
32	16.00	5159	0.09	73	19	52	55
33	16.47	5208	0.08	51	12	62	63
34	16.97	5217	0.07	40	12	43	45
35	17.45	5170	0.07	29	37	60	71
36	17.95	5212	0.06	10	17	57	59
37	18.47	5226	0.06	8	19	44	48
38	18.93	5242	0.05	5	17	45	48
39	19.32	5225	0.05	2	18	47	50
40	20.04	5235	0.04	3	27	43	51
41	20.46	5185	0.04	1	0	72	72

TABLE 2 - POWER PERFORMANCE RESULTS AT SEA LEVEL AIR DENSITY, 1.225kg/m³

Figure 1 shows the Evance R9000 power curve normalised to sea level air density, 1.225kg/m³. The combined standard uncertainties of the results are indicated on the graph by the vertical error bars.

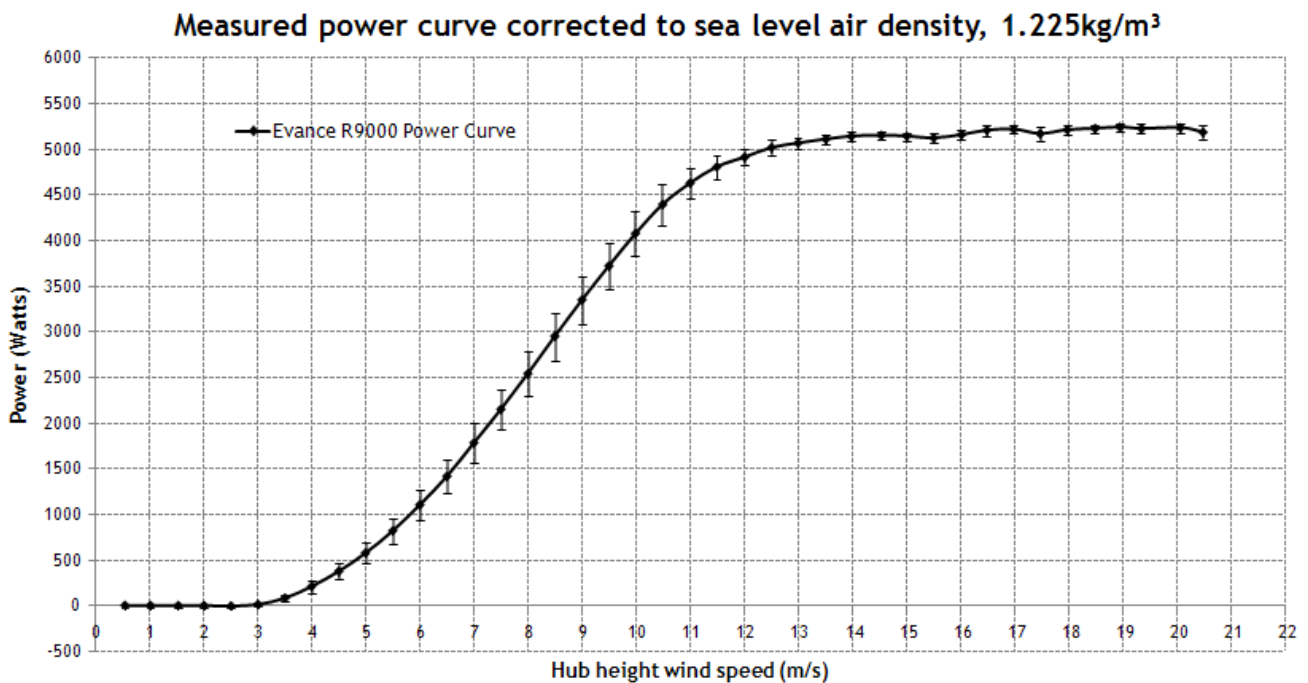


FIGURE 1 - POWER CURVE AND COMBINED STANDARD UNCERTAINTY AT SEA LEVEL AIR DENSITY, 1.225kg/m³

3. Annual Energy Production

Table 3 gives the BWEA Reference Annual Energy for the Evance R9000. Table 4 shows the AEP estimations for hub height integer annual average wind speeds from 4m/s, up to the maximum wind speed for the turbine Class (i.e. 4, 5, 6, 7 and 8m/s for the Class II Evance R9000) at sea level air density.

BWEA Reference Annual Energy (kWh)	8780
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TABLE 3 - BWEA REFERENCE ANNUAL ENERGY

Estimated Annual Energy Production Reference Air Density: 1.225kg/m ³ Cut Out Wind Speed: No cut out wind speed but extrapolation taken up to 25 m/s					
Hub height annual average wind speed (Rayleigh)	AEP-measured (measured power curve)	Standard uncertainty in AEP	Standard uncertainty in AEP	AEP-extrapolated (extrapolated power curve)	
m/s	kWh	kWh	%	kWh	
4	4739	712	15	4739	COMPLETE
5	8779	966	11	8780	COMPLETE
6	13153	1125	9	13186	COMPLETE
7	17201	1191	7	17423	COMPLETE
8	20450	1193	6	21208	COMPLETE

TABLE 4 - ESTIMATED ANNUAL ENERGY PRODUCTION AT SEA LEVEL AIR DENSITY, 1.225kg/m³

Figure 2 shows the expected annual energy production for the Evance R9000 at various hub height wind speeds in graphical format.

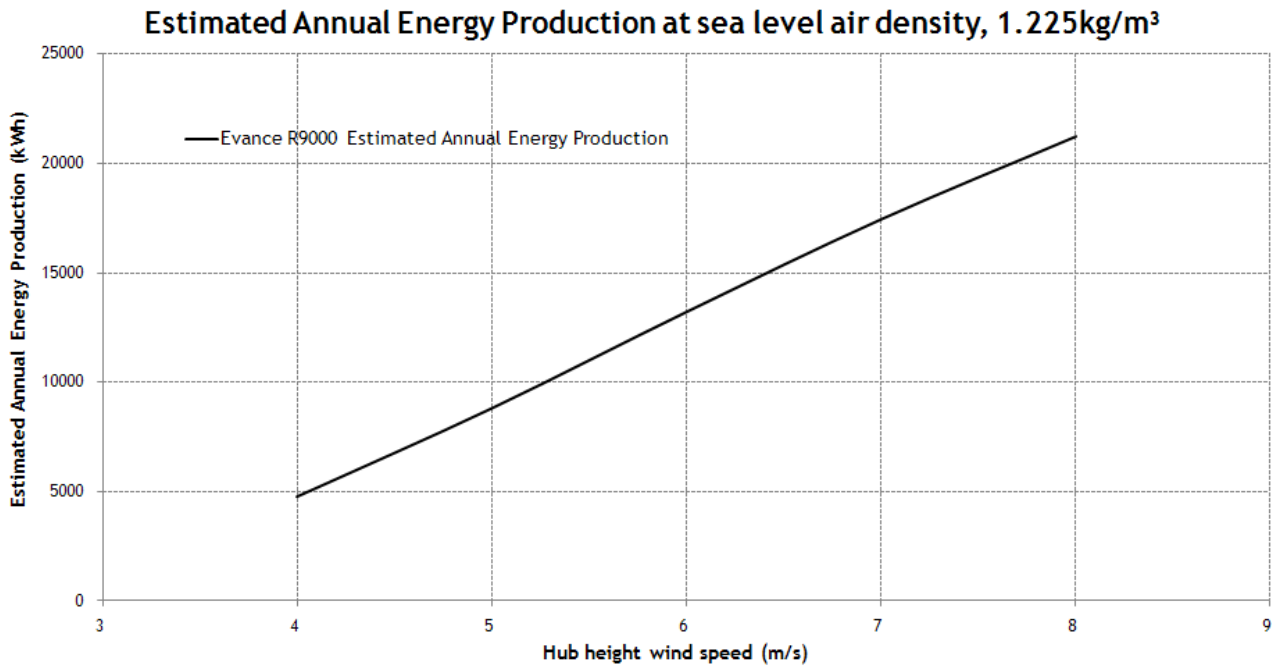


FIGURE 2 - ESTIMATED ANNUAL ENERGY PRODUCTION AT SEA LEVEL AIR DENSITY, 1.225kg/m³

4. Noise Immission

The noise label for the Evance R9000 is below in Figure 3. The key results are the Declared Apparent Emission Sound Power Level, $L_{Wd,8m/s}$, at 8m/s hub height wind speed and noise immission predictions for a range of slant distances and hub height wind speeds.

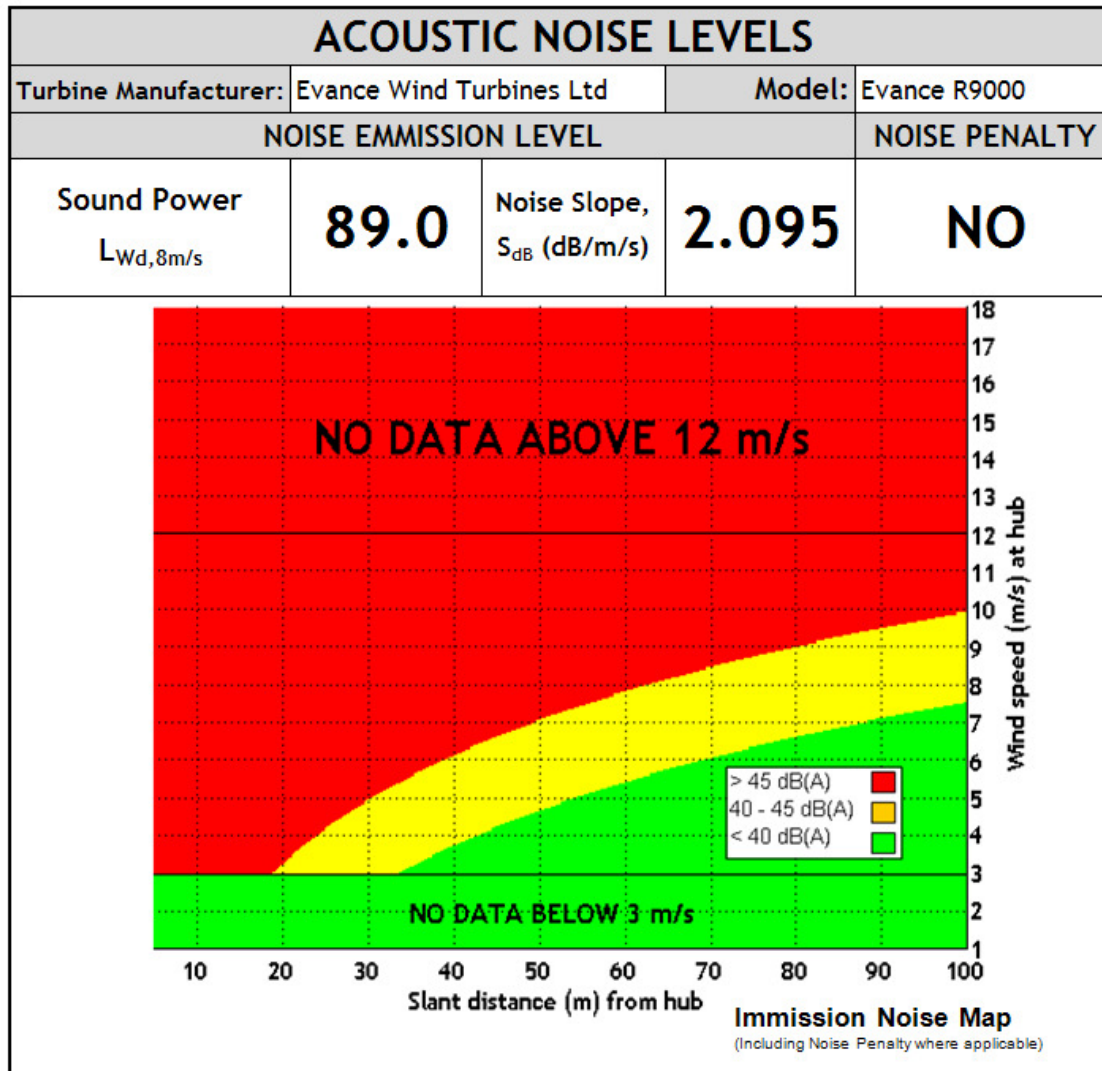


FIGURE 3 - NOISE LABEL

The assessment established the turbine should not be declared as ‘tonal’ and therefore no penalty should be applied.

The BWEA Reference Sound Levels at 25m and 60m at an 8m/s hub height wind speed are:

$$L_{p,25m} = 53dB(A)$$

$$L_{p,60m} = 45.5dB(A)$$

5. Duration Test

Table 5 presents a summary of the results from the duration test. All the requirements were successfully achieved.

Test statistics:

Start date/time: 20/11/2009 at 15:03
 End date/time: 10/06/2010 at 09:55
 Mean hub height wind speed: 8.27m/s
 Average turbulence intensity at 15m/s: 7.96%
 Highest instantaneous wind speed: 34.8m/s

	Requirement	Duration Test Result	PASS/FAIL
GENERAL	At least 6 months of operation	6 months 19 days	PASS
	At least 2500 hours of power production in winds of any velocity	4384 hours	PASS
	At least 250 hours of power production in winds of $1.2V_{ave}$ and above (10.2m/s for Class II)	849 hours	PASS
	At least 25 hours in wind speeds of 15m/s and above	238 hours	PASS
	At least 25 hours of power production in winds of $1.8V_{ave}$ and above (15.3m/s for Class II)	218 hours	PASS
RELIABLE OPERATION	Operational time fraction of at least 90%	100%	PASS
	No major failure of the turbine or components in the turbine system	No major failure	PASS
	No significant wear, corrosion or damage to turbine components	No significant wear, corrosion or damage	PASS
	No significant degradation of produced power at comparison wind speeds	No significant degradation of produced power	PASS
DYNAMIC BEHAVIOUR	No excessive tower vibrations or resonances, turbine noises or tail and yaw movements	Nothing unusual witnessed. Measured tower loads within design limits	PASS

TABLE 5 - DURATION TEST SUMMARY

6. References

1. MCS 006, Product Certification Scheme Requirements: Micro and Small Wind Turbines, Issue 1.5, 10 July 2009
2. MCS 011, Product Certification Scheme Requirements: Acceptance Criteria for Testing Required for Product Certification, Issue 1.4, 10 Jan 2009
3. Small Wind Turbine Performance and Safety Standard. British Wind Energy Association, 29 Feb 2008
4. BS EN 61400-2:2006, Wind turbines, Part 2 - Design requirements for small wind turbines, 2006
5. BS EN 61400-11:2003, Wind Turbine Generator Systems, Part 11 - Acoustic Noise Measurement Techniques, 2003
6. BS EN 61400-12-1:2006, Wind turbines, Part 12-1 - Power performance measurements of electricity producing wind turbines, 2006

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