Bergey Excel 10

UK MCS Certification Summary

Bergey Windpower Co.
2200 Industrial Blvd.
Norman, OK 73069
USA

APPROVED PRODUCT

MCS

BRE GLOBAL LISTED

Certificate No. WT00XX

BWEA small wind turbine standard, 2008

Certified by BRE

Reference Annual Energy 13,840kWh

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

1. Introduction

This document summarizes the results of UK MCS product certification on the Bergey Excel 10 wind turbine. Tests, data processing, and reporting were carried out in accordance with the BWEA Small Wind Turbine Performance and Safety Standard (Feb. 2008), which references IEC 61400-2, 61400-11, and 61400-12.

Field tests were conducted at the USDA/ARS facility at Bushland, Texas. The turbine tested was taken from the production line and is fully representative of current production models.

Sincerely,

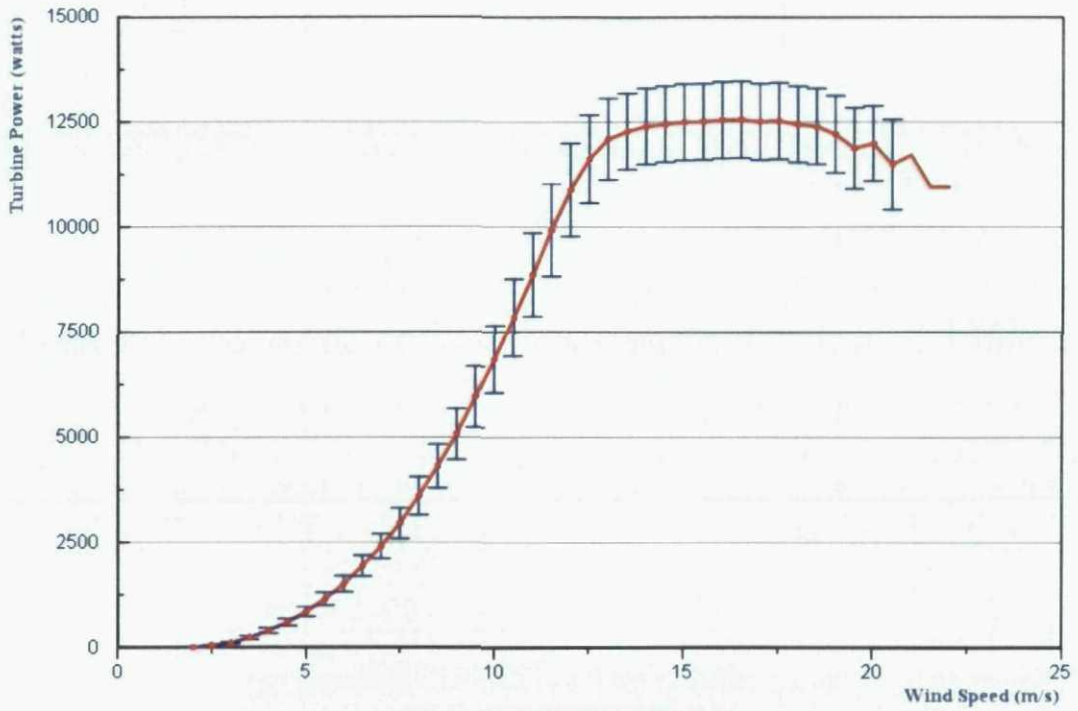
Michael L.S. Bergey
President

2. Power Curve

The following table shows the power performance test results at a wind speed adjusted to a sea level air density of 1.225 kg/m^3

					Category A	Category B	Combined Uncertainty
Bin No.	Hub Height Wind Speed (m/s)	Power Output (Watts)	Cp	No. of One-Min Samples	Standard Uncertainty, Si, Watts	Standard Uncertainty, Ui, Watts	Standard Uncertainty, Ci, Watts
1	0.5	-12	N.A.	158			
2	1	-12	N.A.	224	0.1	0.9	0.9
3	1.5	-11	N.A.	309	0.3	0.9	1.0
4	2	0	N.A.	391	0.9	2.9	3.0
5	2.5	39	0.11	375	2.1	10.9	11.1
6	3	102	0.16	661	3.0	20.2	20.4
7	3.5	229	0.23	818	3.4	43.8	43.9
8	4	399	0.26	1060	3.2	65.4	65.4
9	4.5	596	0.28	1213	3.0	84.5	84.6
10	5	848	0.29	1235	3.7	116.9	117.0
11	5.5	1,151	0.29	1279	4.7	152.6	152.6
12	6	1,510	0.30	1250	5.4	195.2	195.3
13	6.5	1,938	0.30	1401	6.0	248.5	248.6
14	7	2,403	0.30	1355	7.1	293.3	293.4
15	7.5	2,949	0.30	1014	9.9	362.8	362.9
16	8	3,602	0.30	885	12.7	452.4	452.6
17	8.5	4,306	0.30	687	16.8	523.1	523.3
18	9	5,071	0.30	736	18.0	604.1	604.4
19	9.5	5,960	0.29	668	19.7	725.9	726.1
20	10	6,856	0.29	707	21.4	790.8	791.0
21	10.5	7,849	0.29	650	26.2	912.1	912.5
22	11	8,863	0.28	599	28.0	994.0	994.4
23	11.5	9,928	0.28	635	24.3	1098.6	1098.9
24	12	10,885	0.27	606	24.8	1105.8	1106.1
25	12.5	11,619	0.25	504	21.7	1044.8	1045.0
26	13	12,019	0.23	432	15.0	968.6	968.7
27	13.5	12,276	0.21	337	13.3	906.1	906.2
28	14	12,395	0.19	333	7.4	906.0	906.1
29	14.5	12,449	0.17	292	7.2	904.5	904.6
30	15	12,495	0.16	279	3.3	907.5	907.5
31	15.5	12,508	0.14	231	10.3	907.4	907.4
32	16	12,546	0.13	187	5.4	911.0	911.0
33	16.5	12,555	0.12	165	8.5	910.7	910.8
34	17	12,503	0.11	125	24.4	908.8	909.1
35	17.5	12,528	0.10	138	17.8	909.2	909.4
36	18	12,442	0.09	98	36.2	908.2	908.9
37	18.5	12,396	0.08	94	36.8	901.0	901.7
38	19	12,208	0.08	57	65.2	916.2	918.5
39	19.5	11,878	0.07	39	83.4	960.0	963.6
40	20	11,989	0.06	18	130.0	882.0	891.5
41	20.5	11,495	0.06	15	124.6	1066.4	1073.7

The following graph shows the power performance test results for the Bergey Excel 10 at a wind speed adjusted to a sea level air density of 1.225 kg/m^3



BWEA Reference Power (Watts)	8,863
Cut-in Wind Speed (m/s)	2.5
Maximum Power (Watts)	12,689

3. Estimated Annual Energy Production

All ratings have been corrected to a sea level air density of 1.225 kg/m3.

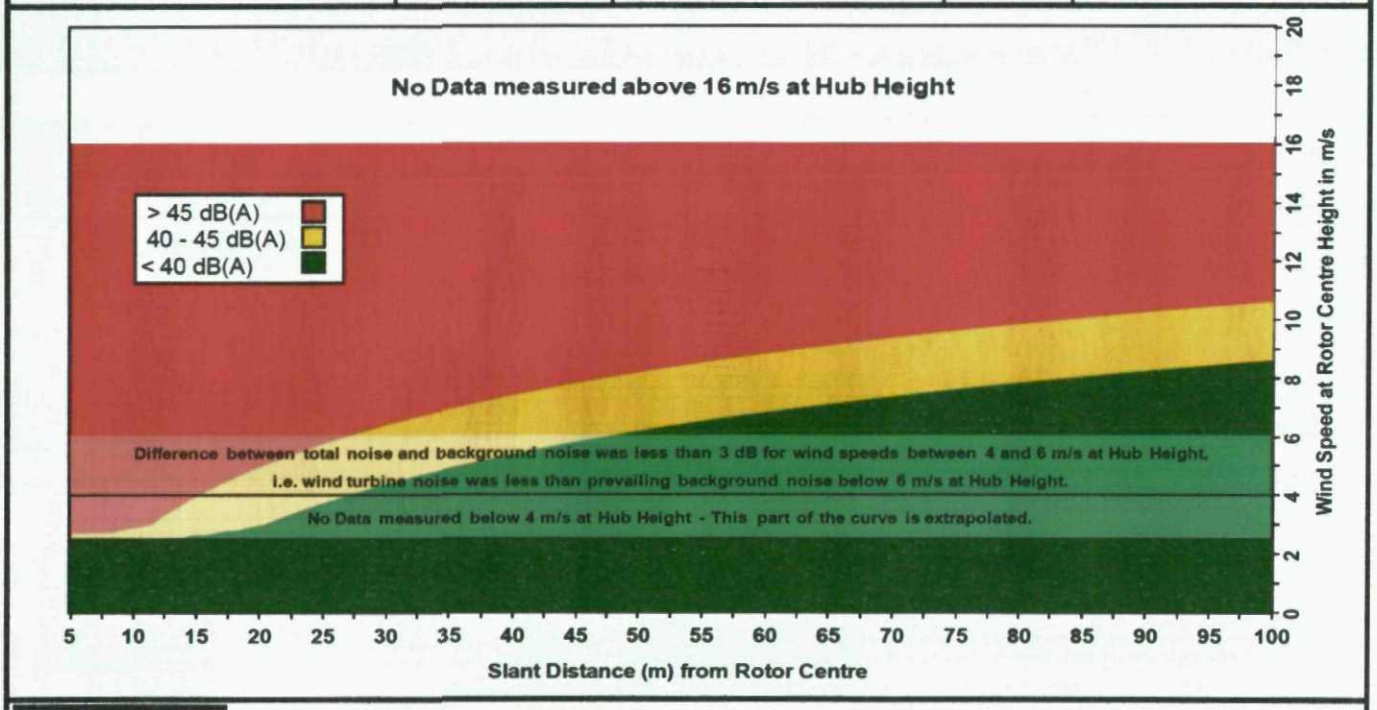
Hub Height Annual Average Wind Speed (m/s)	Estimated Annual Energy Production (kWh)	Standard Uncertainty in AEP (kWh)	Standard Uncertainty in AEP (%)
4	7,135	503	7.05
5	13,842	884	6.39
6	22,300	1,281	5.74
7	31,342	1,604	5.12
8	39,755	1,824	4.59
Reference air density: 1.225 kg/m3			
Cut-out wind speed = n/a			

BWEA Reference Annual Energy (kWh)	13,840

4. Acoustics Emission

The acoustics label for Excel 10 is shown below.

Acoustic Noise Levels				
Turbine Make:	Bergey Windpower Co.	**Model:**		Excel 10 kW Grid-Tie
NOISE EMISSION LEVEL				**NOISE PENALTY**
Sound Power $L_{Wd,8m/s}$	**86.5 dB(A)**	**Noise Slope, S_{dB} (dB/m/s)**	**2.47**	**NO**



	Acoustic Performance Testing by: USDA-ARS / USA July/August/October 2011	Noise Label issued by: Hayes McKenzie Partnership Ltd. / UK October 2011

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

$$L_{p,25m} = 51 \text{ dB(A)}$$

$$L_{p,60m} = 43 \text{ dB(A)}$$

5. Duration Test

Test Statistics:

Start Date: June 24, 2010
End Date: March 18, 2011
Mean Hub Height Wind Speed: 7.3 m/s
Average Turbulence Intensity at 15 m/s: 8.4%
Highest Instantaneous Wind Speed: 31.6 m/s
Tower: 30m Guyed-Lattice

Duration Test for Bergey Excel 10				
Test Requirement	**Required to Pass**	**Test Result**	**Percentage**	**Pass/Fail**
Months of operation	6	8	133%	Pass
Hours of power production	2,500	5,348	214%	Pass
Hours of power production in winds greater than 10.2 m/s (IEC Class II)	250	402	161%	Pass
Hours of power production in winds greater than 15.3 m/s (IEC Class II)	25	59.9	240%	Pass

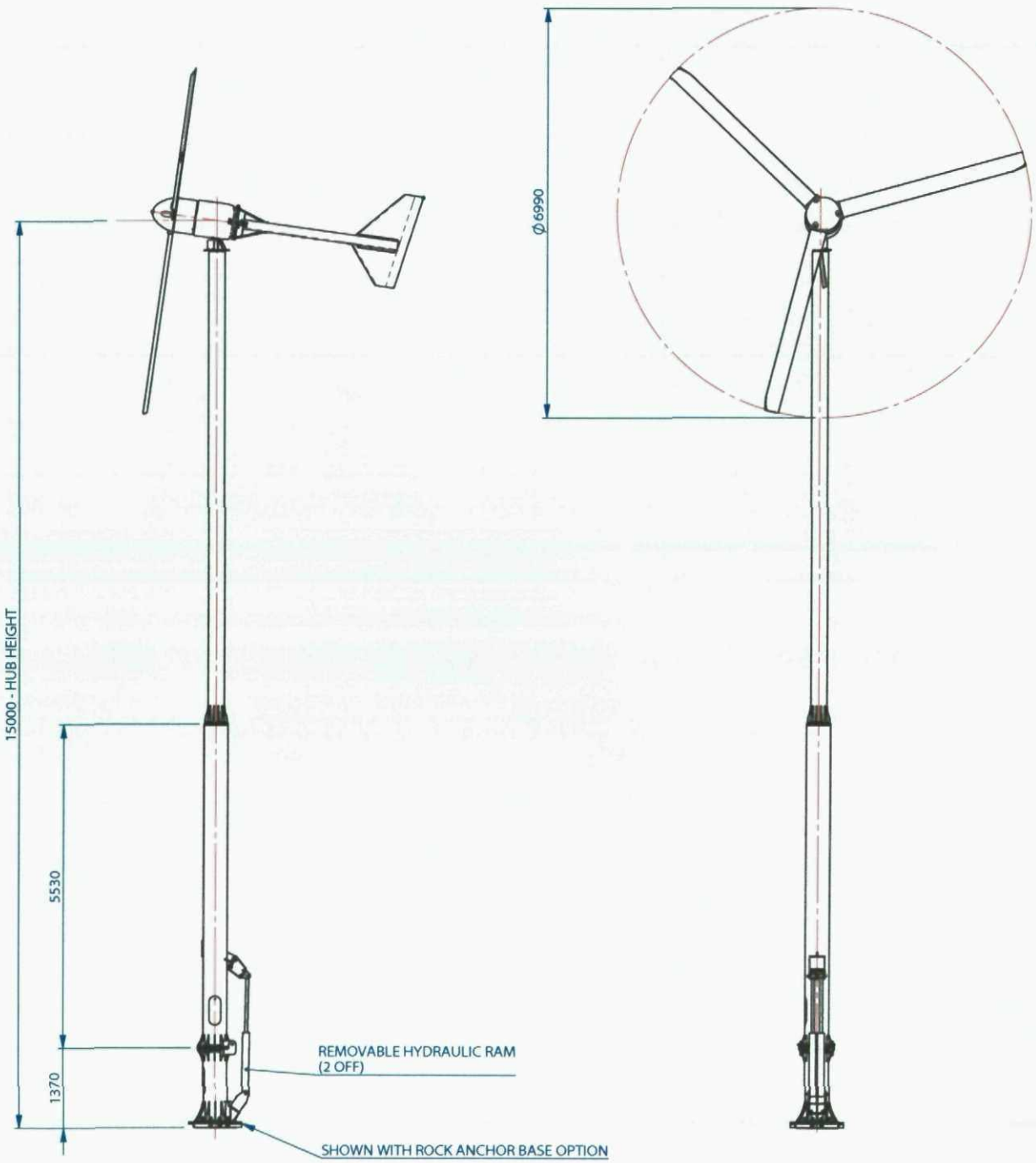
The Bergey Excel 10 operated automatically and unattended throughout the Duration Test.

Test Requirement	**Test Result**	**Pass/Fail**
Operational Time Fraction of at least 90%	100%	Pass
No major failure of turbine or components in the turbine system	No failures	Pass
No significant wear, corrosion, or damage to turbine components	None observed	Pass
No degradation of produced power at comparison wind speeds	None observed	Pass
No excessive tower vibrations or resonances, turbine noises, or tail or yaw movements	None observed	Pass

5. References

1. MCS 006, Product Certification Scheme Requirements: Micro and Small Wind Turbines, Issue 1.5, July 10, 2009
2. MCS 011, Product Certification Scheme Requirements: Acceptance Criteria for Testing Required for Product Certification, Issue 1.4, January 10, 2009
3. Small Wind Turbine Performance and Safety Standard, British Wind Energy Association, February 29, 2008
4. IEC 61400-2:2006, Wind Turbines, Part 2 – Design Requirements for Small Wind Turbines, International Electrotechnical Commission, 2006
5. IEC 61400-11:2003, Wind Turbine Generator Systems, Acoustic Noise Measurement Techniques, International Electrotechnical Commission, 2003
6. IEC 61400-12:2006, Wind Turbine Generator Systems, Power Performance Measurements of Electricity Producing Wind Turbines, International Electrotechnical Commission, 2006

SITE REF.: ABC 123



REV.	DESCRIPTION	DRAWN	APP'D	DATE
C	HUB HEIGHT NOW REFERENCED	A.P.H	I.J.B	11/11/2011
B	SECTIONS MODIFIED	A.P.H	I.J.B	16/11/2011
A	FOR ILLUSTRATION	A.P.H	I.J.B	23/08/2011

NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES WITH LEVELS SHOWN IN METRES.
2. ALL DIMENSIONS NOT TOLERANCED TO BE WITHIN ±0.50mm.
3. STEELWORK TO BE TO BS 7668 OR BS EN 10113-1, GRADE S275 (UNLESS OTHERWISE SPECIFIED), & FABRICATED IN ACCORDANCE WITH BS 5950.
4. ALL BOLTS TO BE GRADE 8.8 SPUN GALVANISED TO BS 3692.
5. ALL STEELWORK TO BE PICKLED AND HOT DIP GALVANISED IN ACCORDANCE WITH BS EN ISO:1461 (UNLESS OTHERWISE SPECIFIED).
6. REMOVE ALL BURRS AND SHARP EDGES.

MATERIAL: SEE DETAILS

FINISH: GALVANISED

MASS (Kg.): 1870.98

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CLIENT: BERGEY
PROJECT: 15M / 10KW RAM STRUCTURE
TITLE: GENERAL ARRANGEMENT DETAILS FOR 15M RAM STRUCTURE TO SUIT BERGEY 10KW TURBINE

A3

DRAWN:	APP'D:	CHK'D:	SCALE:	DATE:
A.P.H	I.J.B.	I.J.B.	1:75	23/08/2011

DWG No.: BGY_15M_10kW_P_001

REVISION: C