ESG
Environmental Scientifics Group
Job Reference: LNO 9999

Boiler Emissions Summary Certificate

For Application
HPK/2014/0287.
Installation of 130kW
Biomass Boiler

Monitoring of Biomass Boilers at D'Alessandro Termomeccanica in order to comply with RHI

Report Date: Version:	19th October 2011 2
Report By: MCERTS Number: MCERTS Level: Technical Endorsements: Signature	Andrew Palliser MM 03 161 MCERTS Level 2 – Business Manager 1, 2, 3 & 4 [redacted]

Prepared by:
Environmental Scientifics Group Limited
5 Crown Industrial Estate
Kenwood Road
Reddish
Stockport
SK5 6PH
0161 443 0980
Prepared for: D'Alessandro Termomeccanica

Introduction

D'Alessandro Termomeccanica operate Wood Burning Boilers at Pescara Italy.

ESG were commissioned by Ashwell Biomass Limited to carry out stack monitoring to determine the emissions from 8 plants under high and low firing conditions. The results of these tests will be used to demonstrate compliance with the emissions limits stated in the Renewable Heat Incentive. The tests were performed in accordance with BS EN 14792 and BS EN 13284-1.

3 test measurements were made at each firing condition on each plant. Therefore a total of 6 tests were performed on each of the 8 boilers.

Boilers Tested

Manufacturer: D'Alessandro Termomeccanica
Model: CS/CSA

2MW
950kW
400kW
230kW
130kW
80kW
40kW
20kW

All the individual UKAS/MCERTS reports complying with ISO 17025 have been included as an appendix.

Results expressed at reference conditions 273K, 101.3kPa and 10% oxygen.

Boiler Emissions Summary

Ashwell Biomass Limited, D'Alessandro Termomeccanica - Emissions Summary

Sampling Dates : 18th - 26th May 2011

*g/GJ has been calculated using concentrations at dry conditions and F factors for Wood as stated in US EPA M19, Table 19-2.
All concentration and emission rates below are based on the mean of 3 results on each firing condition. For individual results see individual stack emisions reports.

Stack	Sampling Date	Total Particulate Matter mg/m³ @ 10% O2	Total Particulate Matter mg/m³ @ Dry ref conditions	Total Particulate Matter g/GJ	Total Particulate Matter g/hr	Nitrogen Oxides mg/m³ @ 10% O2	Nitrogen Oxides mg/m³ @ Dry ref conditions	Nitrogen Oxides g/GJ	Nitrogen Oxides g/hr	Carbon Monoxide mg/m³	VOCs mg/m³	Amount of fuel used kg/hr	Stack Flow Rate m3/hr @ ref conds.
2MW High Fire	18th May 2011	48	63	21	277	228	219	73	1123	1.5	41	448	4936
2MW Low Fire	18th May 2011	45	37	21	83	111	110.5	63	233	204	48	148	2098
950kw High Fire	19th May 2011	48	66	23	128	211	207	71	434	322	-	213	2057
950kw Low Fire	20th May 2011	54	40	26	45	96	95.2	62	111	150	-	70.29	1157
400kw High Fire	20th May 2011	54	63	25	78	186	183	74	254	38	-	100	1366
400kw Low Fire	21st May 2011	71	48	29	54	87	86	61	101	170	-	33	1158
230kw High Fire	23rd May 2011	33	40	16	45	198	198	78	293	250	-	52	1483
230kw Low Fire	24th May 2011	42	28	20	33	89	88	62	106	79	-	17	1192
130kw High Fire	24th May 2011	24	23	12	26	139	139	70	164	52	-	29	1173
130kw Low Fire	24th May 2011	52	29	25	35	72	71	60	83	207	-	9.6	1249
80kw High Fire	25th May 2011	43	47	21	12	189	184	84	29	516	-	17.9	216
80kw Low Fire	25th May 2011	68	44	28	11	96	95	71	24	373	-	5.9	245
40kw High Fire	25th May 2011	42	43	23	10	158	157	86	45	180	-	9	234
40kw Low Fire	26th May 2011	106	40	40	11	70	70	82	15	216	-	3.0	280
20kw High Fire	26th May 2011	87	39	33	10	89	88	86	30	173	-	4.5	266
20kw Low Fire	26th May 2011	45	27	22	7	184	108	87	29	561	-	1.5	151

Values highlighted in red have been corrected for 15% measurement uncertainty as recommended to regulators in EA guidance note M2 v8.

Efficiency Calculations to BS 845-1:1987

Ashwell Biomass Limited, D'Alessandro
Boiler efficiency assessment to BS 845-1:1987

Boiler		2MW	2MW	950KW	950KW	400KW	400KW	230KW	230KW	130KW	130KW	80KW	80KW	40KW	40KW	20KW	20KW
Firing Rate		High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
Fuel		Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wood
Date		18/05/2011	18/05/2011	19/05/2011	20/05/2011	20/05/2011	21/05/2011	23/05/2011	24/05/2011	24/05/2011	24/05/2011	25/05/2011	25/05/2011	25/05/2011	26/05/2011	26/05/2011	26/05/2011
Duration of test		13	32	20	32	20	32	30	30	30	30	20	30	30	30	30	30
Quantity of fuel burnt (M_f)	kg/h	448	148	213	70	100	33	52	17	29	9.6	17.9	5.9	9	3	4.5	1.5
Quantity of fuel burnt	kg	97	79	71	37	33	18	26	9	15	5	6	3	5	2	2	1
Duration of test (T)	s	780	1920	1200	1920	1200	1920	1800	1800	1800	1800	1200	1800	1800	1800	1800	1800
Ambient temperature of combustion air (ta)	oC	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
Gross calorific value mass (Qgr)	kJ/kg	18957	18957	18957	18957	18957	18957	18957	18957	18957	18957	18957	18957	18957	18957	18957	18957
Net calorific value of mass (Qnet)	kJ/kg	17637	17637	17637	17637	17637	17637	17637	17637	17637	17637	17637	17637	17637	17637	17637	17637
Heat supplied by fuel gross (Qigr)	kW	2359	779	1122	370	527	174	274	90	153	51	94	31	47	16	24	8
Heat supplied by fuel net (Qinet)	kW	2195	725	1044	344	490	162	255	83	142	47	88	29	44	15	22	7
Carbon content of fuel (C)	%	47.2	47.2	47.2	47.2	47.2	47.2	47.2	47.2	47.2	47.2	47.2	47.2	47.2	47.2	47.2	47.2
Siegert gross kgr		0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Siegert net knet		0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Flue gas tempertaure (t3)	oC	105	78	85	60	115	60	55	38	74	50	97	43	98	43	98	75
Oxygen content of flue gas	%	5.4	13	5.8	13	8	13.6	7.7	13.6	10.6	14.8	9.5	14	11.4	16.5	15.6	14.5
Volume of CO2 (VCO2)	%	14.4	7.7	14.1	7.7	12.4	7.2	12.9	7.2	10.1	6.0	10.9	6.7	9.1	4.4	5.2	6.2
Loss in flue gas sensible heat (L1gr)	%	3.7	4.7	2.9	3.2	4.9	3.4	1.7	1.4	3.3	3.0	4.5	2.0	5.4	3.1	9.5	5.6
Loss in flue gas sensible heat (L1net)	%	3.7	4.7	2.9	3.2	4.9	3.4	1.7	1.4	3.3	3.0	4.5	2.0	5.4	3.1	9.5	5.6
Hydrogen content (H)	%	5.38	5.38	5.38	5.38	5.38	5.38	5.38	5.38	5.38	5.38	5.38	5.38	5.38	5.38	5.38	5.38
Mositure content of fuel	%	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Losses due to enthalpy in water vapour (L2gr)	%	7.5	7.3	7.4	7.2	7.6	7.2	7.2	7.1	7.3	7.2	7.5	7.1	7.5	7.1	7.5	7.3
Losses due to enthalpy in water vapour (L2net)	%	1.0	0.9	0.9	0.8	1.1	0.8	0.7	0.6	0.8	0.7	1.0	0.6	1.0	0.6	1.0	0.8
Loss due to unburnt gases in flue gas (L3gr)	%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Loss due to unburnt gases in flue gas (L3net)	%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Quantity of Ash collected	kg	1.0	0.8	0.7	0.4	0.3	0.2	0.3	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Quantity of fuel burnt	kg	97	79	71	37	33	18	26	9	15	5	6	3	5	2	2	1
Gross calorific value mass (Qgr)	kJ/kg	18957	18957	18957	18957	18957	18957	18957	18957	18957	18957	18957	18957	18957	18957	18957	18957
Loss due to Combustible matter in Ash (L4gr)	%	0.0020	0.0020	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loss due to Combustible matter in Ash (L4net)	%	0.0022	0.0022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gas & Steam Backed external Surface areas of Boiler	m2	18	18	10	10	7	7	4	4	3	3	2	2	2	2	2	2
Water Flow Temp	oC	74	73	61	73	65	54	62	65	62	54	53	57	59	46	58	59
Ambient Temp	oC	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
Insulation thickness on steam surfaces	mm	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Insulation thickness on gas surfaces	mm	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Radiation and convection losses (L6gross)	%	0.93	1.01	0.92	1.03	0.94	1.02	0.95	1.11	0.98	1.12	0.96	1.15	1.04	1.19	1.17	1.77
Radiation and convection losses (L6net)	%	1.0	1.1	1.0	1.1	1.0	1.1	1.0	1.2	1.1	1.2	1.0	1.2	1.1	1.3	1.3	1.9
Total losses gross (Ltgr)	%	12.19	13.09	11.22	11.48	13.39	11.69	9.83	9.66	11.65	11.34	12.90	10.33	13.94	11.43	18.14	14.66
Total losses gross (Ltnet)	%	5.79	6.69	4.81	5.07	7.00	5.28	3.41	3.25	5.25	4.93	6.50	3.92	7.55	5.02	11.76	8.31
Thermal Efficiency (Egr)	%	87.8	86.9	88.8	88.5	86.6	88.3	90.2	90.3	88.3	88.7	87.1	89.7	86.1	88.6	81.9	85.3
Thermal Efficiency (Enet)	%	94.2	93.3	95.2	94.9	93.0	94.7	96.6	96.8	94.8	95.1	93.5	96.1	92.5	95.0	88.2	91.7
Heat Output (gross)	kW	2071.6	677.3	995.8	327.6	456.1	153.5	246.9	80.9	134.9	44.8	82.1	27.9	40.8	14.0	19.4	6.7
Heat Output (net)	kW	2067.8	676.6	993.3	326.9	455.6	153.1	246.1	80.6	134.6	44.7	82.0	27.8	40.8	14.0	19.5	6.7

Fuel Analysis

Report Number : **11/JUN/COA/6629**

Customer : **Environmental Scientifics Group**
Unit 5 Crown Industrial estate
Kenwood Road
Reddish
Stockport
SK5 6PH

Date Received : 29th June 2011
Sample Date :
Date Analysed : 29th June to 25th July 2011
Report Date : 25th July 2011
Customer Reference :

Test Method	*
Sample Reference	**HSK 2023**
Size Fraction (mm)	**Weight %**
+32.0	NIL
32.0 – 16.0	NIL
16.0 – 12.5	NIL
12.5 – 6.3	NIL
6.3 – 3.15	99.3
3.15 – 2.0	0.4
2.0 – 1.0	0.2
– 1.0	0.2
Total	**100.0**

TES Bretby does not accept responsibility for the sampling relating to the above results.
* Non accredited method for this matrix

Fuel Analysis continued

Report Number : **11/JUN/COA/6044**

Customer : Scientifics Limited

Date Received : 3rd June 2011

Sample Date :

Date Analysed : 6th to 17th June 2011

Report Date : 20th June 2011
Customer Reference : **LNO 9999**

Test Method	Sample Reference	HSK 2023
SP20 & CA2	Total Moisture %	6.0
CA 3	Ash %	4.0
CA 31	Sulphur %	0.01
CA 11	Gross Calorific Value kJ/kg	18957
**	Net Calorific Value kJ/kg	17637
CA 9	Carbon %	47.21
CA 9	Hydrogen %	5.38
CA 9	Nitrogen %	0.28
**	Oxygen %	37.1
Test results calculated to "As received" Moisture Basis		

TES Bretby does not accept responsibility for the sampling relating to the above results.
* Non accredited method for this matrix ** calculated using UKAS accredited results

Report Authorised By .
Jonathan Clay
(Energy Services Reporting)

Conclusion

From the 16 sets of triplicate tests performed, both TPM and NOx were below the respective RHI limits of 30g/GJ for TPM and 150 g/GJ for NOx. There were only 2 occasions when the particulates were slightly above the 30 g/GJ threshold. NOx was below the 150 g/GJ in all cases. It should be noted that if the less stringent Clean Air act limits were imposed all results would be compliant.