



Team Results for Clean Snowmobile Challenge 2013 Team 2



2012 Clean Snowmobile Competition - Lab Emission Event Emission Data Sheet

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Test Date       : 2013/03/07 15:59:21
Team Name      : Kettering
Team Number    : 2
Model         : Rotax
Engine        : 600 ACE
Displacement[cc] : 600.00
100% Speed    : 7042
100% Torque   : 72.9
No of Strokes : 4
Fuel          : GASOLINE           H/C: 2.50       O/C: 0.28
  
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ModeNum	:	1	2	3	4	5
Weighting	:	0.12	0.27	0.25	0.31	0.05
Power kW	:	49.4	24.3	14.3	6.9	0.0
HC_m g/hr	:	103.72	3.69	0.96	3.28	0.21
CO_m g/hr	:	7613.64	5.97	0.10	0.17	0.00
NOx_m g/hr	:	0.89	302.18	203.90	25.37	7.62
Soot_m mg/hr	:	294.98	1.79	1.47	0.44	0.14
N2O_m mg/hr	:	0.00	0.05	0.02	0.01	0.00
CO2_m g/hr	:	49108.20	26926.10	16934.92	11730.99	2818.79
CH4_m g/hr	:	40.25	2.89	0.64	1.88	0.18
W_HC g/hr	:	12.45	1.00	0.24	1.02	0.01
W_CO g/hr	:	913.64	1.61	0.03	0.05	0.00
W_NOx g/hr	:	0.11	81.59	50.97	7.87	0.38
W_HCNOx g/hr	:	12.55	82.59	51.21	8.88	0.39
W_Soot mg/hr	:	35.40	0.48	0.37	0.14	0.01
W_N2O g/hr	:	0.00	0.01	0.01	0.00	0.00
W_CO2 g/hr	:	5892.98	7270.05	4233.73	3636.61	140.94
W_CH4 g/hr	:	4.83	0.78	0.16	0.58	0.01

Total Weighted Power [kW] 18.200

Weighted Emissions

	HC	CO	NOx	HC+NOx
Total Mass [g/hr]	14.71	915.33	140.92	155.63
Specific Mass [g/kW-hr]	0.81	50.29	7.74	8.55
BSFC [g/kW-hr]	421.0			

Total Soot [mg/hr] 36.39 Specific Soot [mg/kW-hr] 2.00

Not Used for Competition

Total N2O [mg/hr]	0.02	Specific N2O [mg/kW-hr]	0.00
Total CO2 [g/hr]	21174.31	Specific CO2 [g/kW-hr]	1163.44
Total CH4 [g/hr]	6.36	Specific CH4 [g/kW-hr]	0.35

EMISSION TESTS:

	Value	Limit	Result
Power	53.77	<96.94 kW	PASS
Soot	2.00	<100 mg/kW-hr	PASS
CO	50.29	<275 g/kW-hr	PASS
HC + NOX	8.55	<90 g/kW-hr	PASS
E-Score	191.73	>100	PASS
Valid Data for All 5 Modes			PASS

LAB EMISSION TEST PASS



**Team Results for
Clean Snowmobile Challenge 2013
Team 2**



Modal Raw Data : Engine / Environmental

ModeNum		1	2	3	4	5
Total Points	points	600	1200	1200	1200	1200
PtsInMode	points	1199	1800	1800	1800	1800
Speed	rpm	7094.62	5988.17	5283.46	4577.95	1695.02
Torque	Nm	66.53	38.81	25.80	14.33	0.00
Power	kW	49.43	24.33	14.27	6.87	0.00
BSFC	g/kw-hr	410.16	365.75	391.98	564.51	**
Fuel	g/hr	20274.81	8900.20	5594.43	3877.99	931.23
T_int	degC	15.83	17.08	17.51	16.17	17.20
RelHumid	%	19.27	19.35	18.95	19.70	19.34
Baro	in Hg	29.26	29.25	29.25	29.25	29.25
Baro	mmHg	743.18	743.06	743.05	743.05	743.05
Pvap_kPa	kPa	0.30	0.33	0.33	0.32	0.33
Pvap_inHg	inHg	0.09	0.10	0.10	0.09	0.10
AbsHumidity	grains/lb	13.37	14.42	14.46	13.94	14.50
SatPres	kPa	98.78	98.74	98.74	98.75	98.74
Hum Factor		0.78	0.78	0.78	0.78	0.78
F_fac		0.98	0.98	0.99	0.98	0.98
K_fac		1.00	1.00	1.00	1.00	1.00
Humidity	g/kg	1.91	2.06	2.07	1.99	2.07
H2		1.31	0.00	0.00	0.00	0.00
WetDry Factor		0.86	0.84	0.86	0.88	0.87



**Team Results for
Clean Snowmobile Challenge 2013
Team 2**



Modal Emissions Concentrations

ModeNum		1	2	3	4	5
THC	ppmC1	718.28	51.23	18.53	83.11	24.54
CO	%	2.74	0.00	0.00	0.00	0.00
N2O	ppm	0.00	2.09	1.53	0.58	0.23
CH4	ppm	253.24	36.47	11.23	43.21	18.87
CO2	%	11.23	12.33	10.85	9.81	10.63
O2	%	0.00	0.73	3.10	4.78	3.43
CNOx	ppm	1.94	1324.22	1249.30	202.91	274.85
AHC	ppm	12.76	0.03	0.00	0.00	0.00
C2H2	ppm	1.93	1.76	1.54	1.56	1.61
C2H4	ppm	51.97	1.44	1.67	3.01	0.39
C3H6	ppm	2.40	0.09	0.03	0.09	0.06
C4H6	ppm	15.49	0.59	0.18	0.19	0.24
ETOH	ppm	17.35	2.99	2.69	2.58	2.18
H2O	%	14.45	15.67	13.63	12.48	13.44
HCHO	ppm	0.76	0.33	0.50	1.15	0.40
HCN	ppm	1.21	0.69	0.51	0.48	0.46
HNCO	ppm	10.22	0.93	1.86	1.02	0.68
MECHO	ppm	3.76	0.11	0.00	0.42	0.07
NC5	ppm	20.95	0.60	0.56	3.98	1.15
NH3	ppm	392.03	10.32	0.10	0.19	0.10
NO	ppm	2.61	1674.78	1501.82	245.83	333.12
NO2	ppm	0.04	26.50	102.93	15.98	20.37
Soot	mg/m3	1.16	0.01	0.02	0.01	0.01
AFR	:1	9.69	11.29	12.96	14.37	13.19



**Team Results for
Clean Snowmobile Challenge 2013
Team 2**



Measurement Accuracy (SAE paper 961804)

	H2_XLS %	ModalHC_Dry %	ModalFTIR_H2O %	N2 %	Ar %	AFR :1	Tr_Eff -
1	1.536	0.084	14.447	81.663	0.944	14.044	1.000
2	0.002	0.006	15.671	87.147	1.007	16.047	0.963
3	0.000	0.002	13.632	85.756	0.991	18.208	0.844
4	0.000	0.009	12.476	85.269	0.986	20.056	0.761
5	0.000	0.003	13.438	85.470	0.988	18.503	0.828

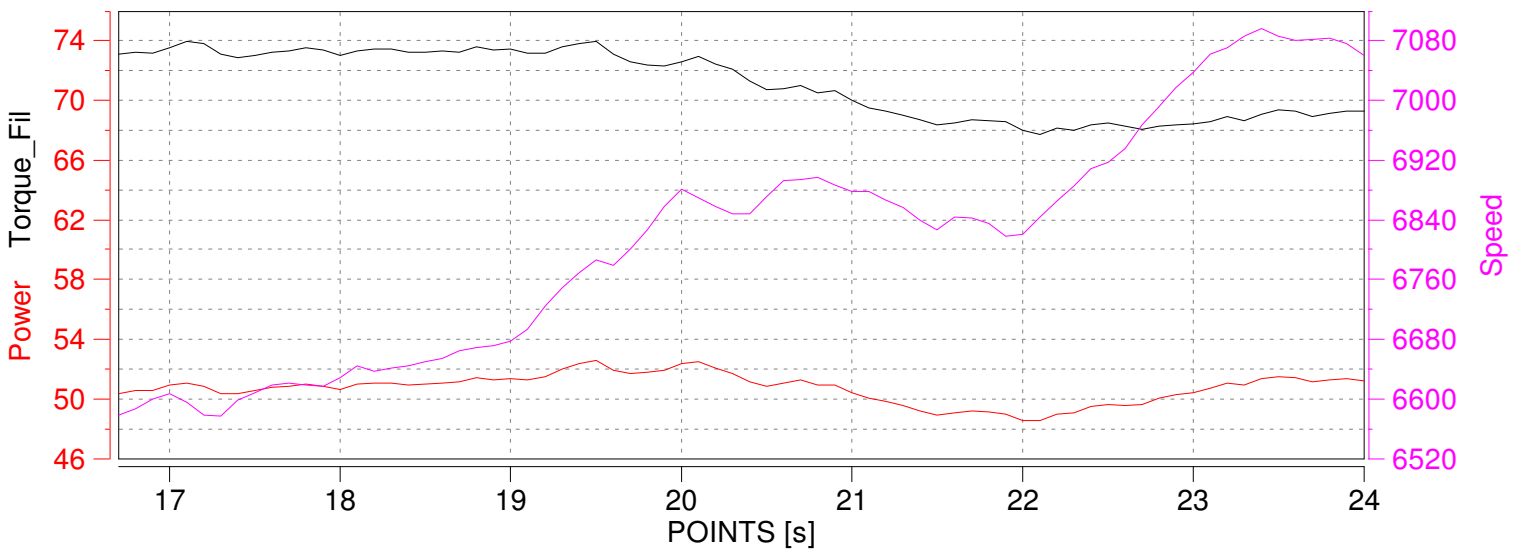
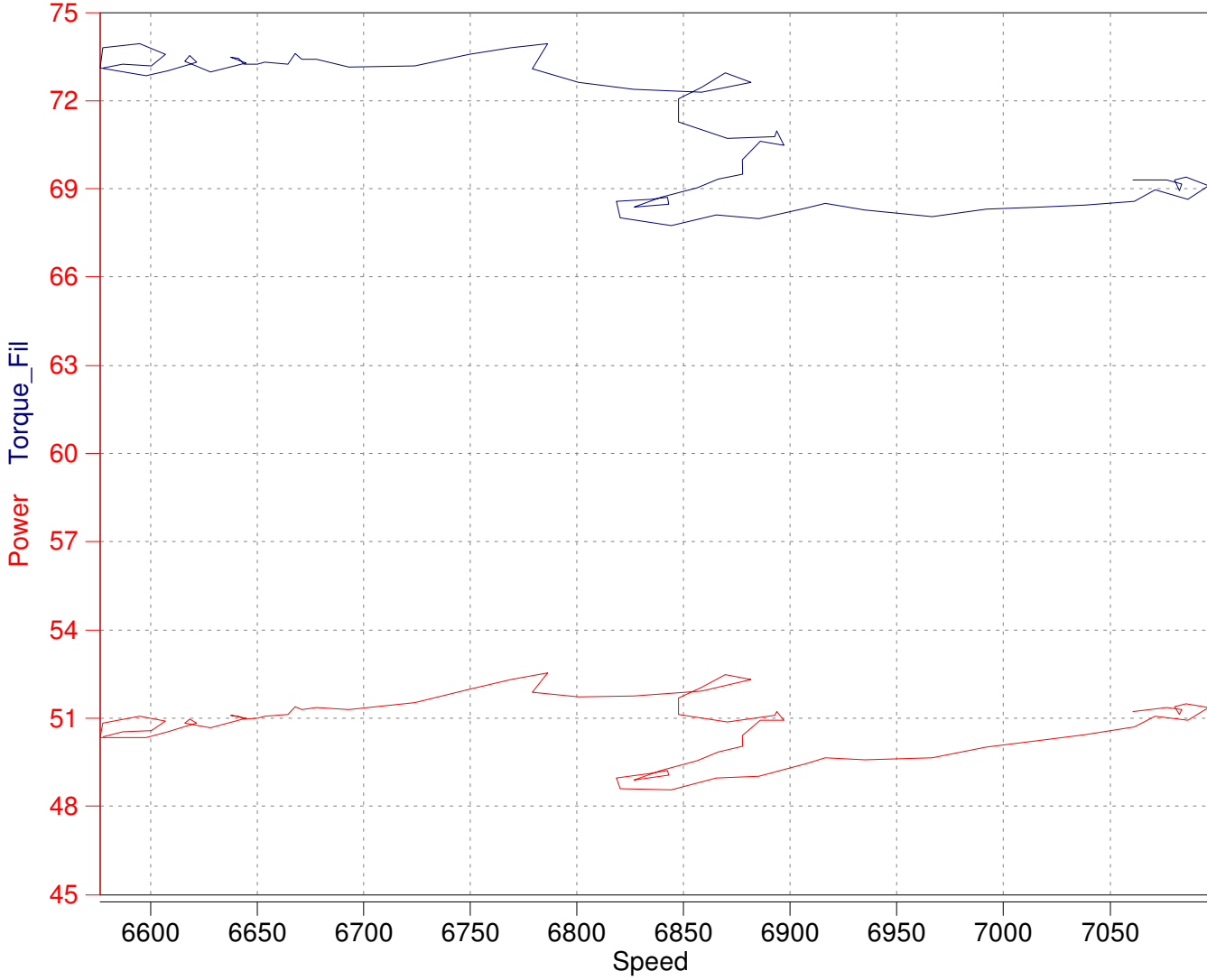
	ModalWHC %	ModalC1 %	ModalC8 %	ModalSUM_HC %	ModalT_Emiss %	ModalError %
	103.717	0.084	0.010	0.094	100.566	0.566
	3.694	-0.531	-0.066	-0.598	103.253	3.253
	0.956	-1.952	-0.244	-2.196	100.881	0.881
	3.284	-2.672	-0.334	-3.006	99.947	0.053
	0.215	-2.109	-0.264	-2.373	100.362	0.362

Power Run

Team 2

TeamNumber	2
TeamName	Kettering
Model	Rotax
Engine	600 ACE

Displacement cc	600.00
RatedSpeed	7042
RatedTorque	72.9





Team Results for Clean Snowmobile Challenge 2013 Team 2 ECO



2012 Clean Snowmobile Competition - Lab Emission Event Emission Data Sheet

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Test Date       : 2013/03/07 16:39:00
Team Name      : Kettering
Team Number    : 2
Model         : Rotax
Engine        : 600 ACE
Displacement[cc] : 600.00
100% Speed    : 6594
100% Torque   : 40.0
No of Strokes : 4
Fuel          : GASOLINE           H/C: 2.50       O/C: 0.28
  
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ModeNum	:	1	2	3	4	5
Weighting	:	0.12	0.27	0.25	0.31	0.05
Power kW	:	29.6	13.4	7.4	3.5	0.0
HC_m g/hr	:	15.59	1.83	6.65	5.88	0.15
CO_m g/hr	:	461.91	0.27	0.38	0.27	0.00
NOx_m g/hr	:	1.04	133.70	38.13	8.38	4.20
Soot_m mg/hr	:	17.80	1.11	0.45	0.39	0.10
N2O_m mg/hr	:	0.00	0.02	0.01	0.01	0.00
CO2_m g/hr	:	32621.43	17453.43	12917.42	9465.83	2449.63
CH4_m g/hr	:	7.11	1.01	2.04	2.16	0.10
W_HC g/hr	:	1.87	0.49	1.66	1.82	0.01
W_CO g/hr	:	55.43	0.07	0.10	0.08	0.00
W_NOx g/hr	:	0.12	36.10	9.53	2.60	0.21
W_HCNOx g/hr	:	2.00	36.59	11.19	4.42	0.22
W_Soot mg/hr	:	2.14	0.30	0.11	0.12	0.00
W_N2O g/hr	:	0.00	0.00	0.00	0.00	0.00
W_CO2 g/hr	:	3914.57	4712.43	3229.36	2934.41	122.48
W_CH4 g/hr	:	0.85	0.27	0.51	0.67	0.01

Total Weighted Power [kW] 10.104

Weighted Emissions

	HC	CO	NOx	HC+NOx
Total Mass [g/hr]	5.86	55.68	48.56	54.42
Specific Mass [g/kW-hr]	0.58	5.51	4.81	5.39
BSFC [g/kW-hr]	582.4			

Total Soot [mg/hr] 2.67 Specific Soot [mg/kW-hr] 0.26

Not Used for Competition

Total N2O [mg/hr]	0.01	Specific N2O [mg/kW-hr]	0.00
Total CO2 [g/hr]	14913.24	Specific CO2 [g/kW-hr]	1476.04
Total CH4 [g/hr]	2.31	Specific CH4 [g/kW-hr]	0.23

EMISSION TESTS:

	Value	Limit	Result
Power	27.59	<96.94 kW	PASS
Soot	0.26	<100 mg/kW-hr	PASS
CO	5.51	<275 g/kW-hr	PASS
HC + NOX	5.39	<90 g/kW-hr	PASS
E-Score	205.03	>100	PASS
Valid Data for All 5 Modes			PASS

LAB EMISSION TEST PASS



**Team Results for
Clean Snowmobile Challenge 2013
Team 2 ECO**



Modal Raw Data : Engine / Environmental

ModeNum		1	2	3	4	5
Total Points	points	600	1200	1200	1200	1200
PtsInMode	points	1200	1800	1800	1801	1800
Speed	rpm	6593.14	5602.60	4934.98	4281.44	1690.30
Torque	Nm	42.86	22.86	14.27	7.83	0.00
Power	kW	29.59	13.41	7.38	3.51	0.00
BSFC	g/kw-hr	372.74	430.04	579.32	892.61	**
Fuel	g/hr	11029.82	5766.65	4273.34	3132.49	809.24
T_int	degC	17.36	17.63	17.27	16.93	16.93
RelHumid	%	19.61	19.39	19.97	19.49	19.16
Baro	in Hg	29.25	29.25	29.26	29.25	29.25
Baro	mmHg	743.04	743.06	743.10	743.06	743.04
Pvap_kPa	kPa	0.34	0.34	0.34	0.33	0.32
Pvap_inHg	inHg	0.10	0.10	0.10	0.10	0.09
AbsHumidity	grains/lb	14.84	14.89	15.04	14.39	14.15
SatPres	kPa	98.73	98.73	98.73	98.74	98.74
Hum Factor		0.78	0.78	0.78	0.78	0.78
F_fac		0.99	0.99	0.98	0.98	0.98
K_fac		1.00	1.00	1.00	1.00	1.00
Humidity	g/kg	2.12	2.13	2.15	2.06	2.02
H2		0.12	0.00	0.00	0.00	0.00
WetDry Factor		0.84	0.87	0.88	0.88	0.87



**Team Results for
Clean Snowmobile Challenge 2013
Team 2 ECO**



Modal Emissions Concentrations

ModeNum		1	2	3	4	5
THC	ppmC1	182.02	32.04	151.15	180.09	20.44
CO	%	0.28	0.00	0.00	0.00	0.00
N2O	ppm	0.00	1.07	0.77	0.54	0.17
CH4	ppm	75.43	16.16	42.09	59.95	12.23
CO2	%	12.58	10.12	9.70	9.57	10.68
O2	%	0.00	4.27	4.97	5.18	3.35
CNOx	ppm	3.82	741.55	273.77	81.12	175.37
AHC	ppm	0.82	0.00	0.00	0.00	0.00
C2H2	ppm	2.12	1.64	1.81	1.94	1.86
C2H4	ppm	11.89	3.53	6.38	4.94	0.39
C3H6	ppm	0.00	0.07	0.16	0.37	0.09
C4H6	ppm	20.68	0.18	0.18	0.14	0.22
ETOH	ppm	16.14	2.82	4.39	4.92	3.08
H2O	%	16.38	13.13	12.36	12.16	13.48
HCHO	ppm	0.48	0.80	1.78	2.56	0.44
HCN	ppm	0.86	0.50	0.54	0.52	0.58
HNCO	ppm	11.33	1.51	0.72	0.51	0.45
MECHO	ppm	0.27	0.00	0.13	0.24	0.00
NC5	ppm	4.01	0.80	12.92	14.45	1.55
NH3	ppm	530.63	0.70	0.19	0.11	0.10
NO	ppm	5.28	885.30	331.37	99.12	211.90
NO2	ppm	0.01	65.74	19.63	5.03	13.75
Soot	mg/m3	0.12	0.01	0.01	0.01	0.01
AFR	:1	10.69	13.93	14.51	14.70	13.13



**Team Results for
Clean Snowmobile Challenge 2013
Team 2 ECO**



Measurement Accuracy (SAE paper 961804)

	H2_XLS %	ModalHC_Dry %	ModalFTIR_H2O %	N2 %	Ar %	AFR :1	Tr_Eff -
1	0.142	0.022	16.377	87.033	1.006	15.270	1.000
2	0.000	0.004	13.130	86.238	0.997	19.473	0.786
3	0.000	0.017	12.359	85.298	0.986	20.277	0.752
4	0.000	0.021	12.160	85.120	0.984	20.532	0.741
5	0.000	0.002	13.477	85.461	0.988	18.415	0.832

	ModalWHC %	ModalC1 %	ModalC8 %	ModalSUM_HC %	ModalT_Emiss %	ModalError %
	15.594	0.022	0.003	0.024	103.581	3.581
	1.825	-2.487	-0.311	-2.797	101.110	1.110
	6.651	-2.732	-0.342	-3.074	99.981	0.019
	5.881	-2.804	-0.351	-3.155	99.758	0.242
	0.155	-2.076	-0.259	-2.335	100.361	0.361

Power Run

Team 2 ECO

TeamNumber	2
TeamName	Kettering
Model	Rotax
Engine	600 ACE

Displacement cc	600.00
RatedSpeed	6594
RatedTorque	40.0

