



Team Results for Clean Snowmobile Challenge 2018 Team 2



2018 Clean Snowmobile Competition - Lab Emission Event Emission Data Sheet

Test Date : 2018/03/08 13:44:05
Team Name : Madison
Team Number : 2
Model : Rotax
Engine : Ace
Displacement[cc] : 674.00
100% Speed : 6061
100% Torque : 53.8
No of Strokes : 4
Fuel : GASOLINE H/C: 2.04 O/C: 0.07

ModeNum	:	1	2	3	4	5	RMC
Weighting	:	0.12	0.27	0.25	0.31	0.05	1.00
Power kW	:	33.7	14.9	8.4	4.6	0.0	11.1
HC_m g/hr	:	9.06	7.70	10.87	8.79	0.52	3.28
CO_m g/hr	:	4.86	1.05	0.87	0.31	0.19	13.18
NOx_m g/hr	:	492.97	83.74	10.89	4.49	2.77	55.35
Soot_m mg/hr	:	52.24	6.13	3.48	0.53	0.13	8.47
N2O_m mg/hr	:	0.15	0.02	0.00	0.00	0.00	0.02
CO2_m g/hr	:	27783.98	14259.26	10922.46	8967.41	4446.47	13300.05
CH4_m g/hr	:	1.87	1.30	2.19	2.53	0.15	2.04
W_HC g/hr	:	1.09	2.08	2.72	2.73	0.03	3.28
W_CO g/hr	:	0.58	0.28	0.22	0.09	0.01	13.18
W_NOx g/hr	:	59.16	22.61	2.72	1.39	0.14	55.35
W_HCNOx g/hr	:	60.24	24.69	5.44	4.12	0.16	58.63
W_Soot mg/hr	:	6.27	1.65	0.87	0.16	0.01	8.47
W_N2O g/hr	:	0.02	0.00	0.00	0.00	0.00	0.02
W_CO2 g/hr	:	3334.08	3850.00	2730.62	2779.90	222.32	13300.05
W_CH4 g/hr	:	0.22	0.35	0.55	0.78	0.01	2.04

Total Weighted Power [kW] 11.581

Weighted Emissions

	HC	CO	NOx	HC+NOx
Total Mass [g/hr]	8.64	1.19	86.02	94.66
Specific Mass [g/kW-hr]	0.75	0.10	7.43	8.17
BSFC [g/kW-hr]	412.9			

Total Soot [mg/hr] 8.96 Specific Soot [mg/kW-hr] 0.77

Not Used for Competition

Total N2O [mg/hr]	0.02	Specific N2O [mg/kW-hr]	0.00
Total CO2 [g/hr]	12916.91	Specific CO2 [g/kW-hr]	1115.39
Total CH4 [g/hr]	1.91	Specific CH4 [g/kW-hr]	0.17
RMC BSFC [g/kW-hr]	382.50		

EMISSION TESTS:

	Value	Limit	Result
Power	34.12	<96.94 kW	PASS
Soot	0.77	<50 mg/kW-hr	PASS
CO	0.10	<275 g/kW-hr	PASS
HC + NOX	8.17	<90 g/kW-hr	PASS
E-Score	204.53	>175	PASS
Valid Data for All 5 Modes			PASS
RMC			PASS
LAB EMISSION TEST			PASS



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Modal Raw Data : Engine / Environmental

ModeNum		1	2	3	4	5	RMC
Total Points	points	600	1520	1200	1200	1200	11431
PtsInMode	points	1210	3370	3470	1800	1479	11431
Speed	rpm	6061.63	5152.32	4545.54	4251.68	2169.54	4675.98
Torque	Nm	53.10	27.54	17.64	10.32	0.00	22.75
Power	kW	33.70	14.86	8.40	4.60	0.00	11.14
BSFC	g/kw-hr	263.84	307.29	417.05	625.69	**	382.50
Fuel	g/hr	8892.35	4566.04	3502.56	2875.28	1421.88	4261.11
T_int	degC	22.99	23.31	21.21	23.38	22.47	22.74
RelHumid	%	26.33	22.94	23.90	25.98	25.94	24.60
Baro	in Hg	28.80	28.80	28.80	28.80	28.80	28.80
Baro	mmHg	731.60	731.51	731.53	731.56	731.52	731.54
Pvap_kPa	kPa	0.61	0.54	0.51	0.62	0.59	0.57
Pvap_inHg	inHg	0.18	0.16	0.15	0.18	0.17	0.17
AbsHumidity	grains/lb	27.64	24.48	22.76	27.84	26.46	25.46
SatPres	kPa	96.92	96.98	97.02	96.91	96.94	96.96
Hum Factor		0.82	0.81	0.80	0.82	0.81	0.81
F_fac		1.02	1.02	1.01	1.02	1.02	1.02
K_fac		1.03	1.03	1.03	1.03	1.03	1.03
Humidity	g/kg	3.95	3.50	3.25	3.98	3.78	3.64
H2		0.00	0.00	0.00	0.00	0.00	0.01
WetDry Factor		0.86	0.86	0.87	0.86	0.87	1.00



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Modal Emissions Concentrations

ModeNum		1	2	3	4	5	RMC
THC	ppmC1	126.42	212.11	382.77	379.98	42.32	94.71
CO	%	0.00	0.00	0.00	0.00	0.00	0.02
N2O	ppm	6.80	1.38	0.39	0.22	0.38	1.59
CH4	ppm	22.96	31.47	67.78	96.12	10.66	51.73
CO2	%	12.39	12.56	12.29	12.39	11.50	12.28
O2	%	1.08	0.85	1.23	1.08	2.44	1.42
CNOx	ppm	2103.50	705.68	117.21	59.36	68.53	488.90
AHC	ppm	0.80	0.36	0.10	0.15	0.09	0.46
C2H2	ppm	0.93	0.89	0.86	0.91	0.91	0.93
C2H4	ppm	2.59	4.84	7.46	3.59	0.34	5.02
C3H6	ppm	0.44	0.45	0.48	0.52	0.31	0.50
C4H6	ppm	0.40	0.44	0.43	0.35	0.34	0.59
ETOH	ppm	0.72	0.60	1.15	0.18	1.73	0.82
H2O	%	13.59	13.72	13.38	13.72	12.51	0.00
HCHO	ppm	0.96	1.53	2.12	2.36	0.90	1.68
HCN	ppm	0.36	0.44	0.30	0.42	0.31	0.42
HNCO	ppm	1.51	0.62	0.34	1.04	0.46	0.89
MECHO	ppm	0.00	0.00	0.00	0.00	0.00	0.00
NC5	ppm	2.20	4.58	4.31	2.47	1.71	4.06
NH3	ppm	0.04	0.02	0.01	0.35	0.05	6.76
NO	ppm	2562.45	863.19	144.17	71.58	78.37	597.32
NO2	ppm	9.21	10.01	1.81	0.99	5.79	5.48
Soot	mg/m3	0.42	0.10	0.07	0.01	0.01	0.14
AFR	:1	14.25	14.00	14.20	14.09	15.34	14.46



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Measurement Accuracy (SAE paper 961804)

ModeNum	H2_XLS %	ModalHC_Dry %	ModalFTIR_H2O %	N2 %	Ar %	AFR :1	Tr_Eff -
1	0.001	0.015	13.588	83.842	0.969	15.746	0.945
2	0.001	0.025	13.721	83.546	0.966	15.480	0.957
3	0.001	0.044	13.378	82.965	0.959	15.742	0.938
4	0.000	0.044	13.717	83.580	0.966	15.615	0.945
5	0.000	0.005	12.506	82.547	0.954	16.883	0.877

ModeNum	ModalWHC %	ModalC1 %	ModalC8 %	ModalSUM_HC %	ModalT_Emiss %	ModalError %
1	9.060	-0.772	-0.097	-0.869	99.839	0.161
2	7.697	-0.606	-0.076	-0.682	99.480	0.520
3	10.875	-0.841	-0.105	-0.946	98.601	1.399
4	8.794	-0.743	-0.093	-0.836	99.324	0.676
5	0.523	-1.613	-0.202	-1.815	97.630	2.370

Carbon Balance Verification

		1	2	3	4	5	6
Power	kW	33.704	14.859	8.398	4.595	0.000	11.140
BSFC	g/kw-hr	263.84	307.29	417.05	625.69	**	382.50
Fuel_MassFlow	g/hr	8892.3	4566.0	3502.6	2875.3	1421.9	4261.1
HC_m	g/hr	9.060	7.697	10.875	8.794	0.523	3.279
CO_m	g/hr	4.858	1.053	0.872	0.306	0.188	13.181
CO2_m	g/hr	27784	14259	10922	8967	4446	13300
TW_Power	kW	11.581					
TW_BSFC	g/kw-hr	412.85					
Fuel_MassFlow	g/hr	8892.3	4566.0	3502.6	2875.3	1421.9	4261.1
FuelCalc	g/hr	9601.8	4930.9	3783.4	3105.8	1535.2	4600.9
FuelCalcDev	%	-7.9785	-7.9908	-8.0170	-8.0162	-7.9664	-7.9739

\$HCR_ENG	2.04
\$OCR_ENG	0.07
MassFracCFuel H/C ratio	0.79086

Power Run

Team 2

TeamNumber	2
TeamName	Madison
Model	Rotax
Engine	Ace

Displacement cc	674.00
RatedSpeed	6061
RatedTorque	53.8

