



## Team Results for Clean Snowmobile Challenge 2011

### 2011 Clean Snowmobile Competition - Lab Emission Event Emission Data Sheet

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Test Date      :
Team Name     : Clarkson University
Team Number   : 12
Model        : CU
Engine       : CU
Displacement[cc] : 600cc
100% Speed   : 7182
100% Torque  : 48.7
No of Strokes : 4
Fuel         : Gasoline           H/C: 1.92       O/C: 0.10
  
```

ModeNum	:	1	2	3	4	5
Weighting	:	0.12	0.27	0.25	0.31	0.05
Power kW	:	36.5	17.6	8.9	5.0	0.0
HC_m g/hr	:	126.44	1.02	0.85	0.44	0.06
CO_m g/hr	:	10989.35	1.05	0.00	0.00	0.00
NOx_m g/hr	:	2.51	545.59	382.48	153.83	1.97
Soot_m mg/hr	:	3338.29	1.43	2.72	0.02	0.00
N2O_m mg/hr	:	0.01	0.05	0.04	0.06	0.00
CO2_m g/hr	:	47115.07	26718.38	15908.14	11167.03	3386.73
CH4_m g/hr	:	31.49	0.66	0.68	0.46	0.08
W_HC g/hr	:	15.17	0.28	0.21	0.14	0.00
W_CO g/hr	:	1318.72	0.28	0.00	0.00	0.00
W_NOx g/hr	:	0.30	147.31	95.62	47.69	0.10
W_HCN0x g/hr	:	15.47	147.59	95.83	47.82	0.10
W_Soot mg/hr	:	400.60	0.39	0.68	0.01	0.00
W_N2O g/hr	:	0.00	0.01	0.01	0.02	0.00
W_CO2 g/hr	:	5653.81	7213.96	3977.03	3461.78	169.34
W_CH4 g/hr	:	3.78	0.18	0.17	0.14	0.00

Total Weighted Power [kW] 12.894

#### Weighted Emissions

	HC	CO	NOx	HC+NOx
Total Mass [g/hr]	15.80	1319.01	291.02	306.82
Specific Mass [g/kW-hr]	1.23	102.29	22.57	23.79
BSFC [g/kW-hr]	558.4			

Total Soot [mg/hr] 401.67      Specific Soot [mg/kW-hr] 31.15

#### Not Used for Competition

Total N2O [mg/hr]	0.04	Specific N2O [mg/kW-hr]	0.00
Total CO2 [g/hr]	20475.92	Specific CO2 [g/kW-hr]	1587.99
Total CH4 [g/hr]	4.27	Specific CH4 [g/kW-hr]	0.33

#### EMISSION TESTS:

	Value	Limit	Result
Power	36.63	<96.94 kW	PASS
Soot	31.15	<100 mg/kW-hr	PASS
CO	102.29	<275 g/kW-hr	PASS
HC + NOX	23.79	<90 g/kW-hr	PASS
E-Score	168.56	>100	PASS
Valid Data for All 5 Modes			PASS

LAB EMISSION TEST      PASS



## Team Results for Clean Snowmobile Challenge 2011

### Modal Raw Data : Engine / Environmental

ModeNum		1	2	3	4	5
Total Points	points	547	1212	1202	1211	1201
PtsInMode	points	605	1212	1202	1211	1201
Speed	rpm	7171.71	6152.50	5370.26	4677.27	1734.63
Torque	Nm	48.56	27.25	15.81	10.24	0.00
Power	kW	36.47	17.56	8.89	5.01	0.00
BSFC	g/kw-hr	562.96	482.34	567.29	705.89	**
Fuel	g/hr	20531.39	8469.58	5042.72	3539.68	1073.43
T_int	degC	5.41	5.73	5.42	5.94	3.19
RelHumid	%	41.85	40.91	39.77	40.52	44.17
Baro	in Hg	28.97	28.96	28.96	28.96	28.97
Baro	mmHg	735.78	735.68	735.63	735.67	735.95
Pvap kPa	kPa	0.36	0.36	0.34	0.36	0.33
Pvap inHg	inHg	0.11	0.11	0.10	0.11	0.10
AbsHumidity	grains/lb	15.93	15.89	15.16	15.94	14.68
SatPres	kPa	97.74	97.72	97.74	97.72	97.79
Hum Factor		0.78	0.78	0.78	0.78	0.78
F_fac		0.97	0.97	0.97	0.97	0.96
K_fac		0.99	0.99	0.99	0.99	0.99
Humidity	g/kg	2.28	2.27	2.17	2.28	2.10
H2		1.56	0.00	0.00	0.00	0.00
WetDry Factor		0.87	0.88	0.87	0.88	0.89



## Team Results for Clean Snowmobile Challenge 2011

### Modal Emissions Concentrations

ModeNum		1	2	3	4	5
THC	ppmC1	922.24	14.61	21.22	15.56	5.46
CO	%	3.99	0.00	0.00	0.00	0.00
N2O	ppm	0.22	2.08	3.56	7.14	0.27
CH4	ppm	200.25	8.17	14.74	14.15	6.84
CO2	%	10.89	12.10	12.58	12.50	10.45
O2	%	0.00	2.15	1.47	1.63	4.59
CNOx	ppm	5.56	2363.28	2893.54	1647.52	58.20
AHC	ppm	57.19	0.00	0.00	0.00	0.00
C2H2	ppm	1.26	0.19	0.28	0.25	0.28
C2H4	ppm	57.90	1.91	1.00	0.50	0.34
C3H6	ppm	10.95	0.06	0.04	0.12	0.05
C4H6	ppm	12.26	0.07	0.03	0.06	0.11
ETOH	ppm	12.24	1.47	1.75	1.98	2.00
H2O	%	12.60	12.21	12.54	11.84	10.72
HCHO	ppm	0.62	0.55	0.22	0.10	0.16
HCN	ppm	1.50	0.25	0.28	0.26	0.15
HNCO	ppm	11.07	3.97	5.03	3.74	2.00
MECHO	ppm	3.07	0.00	0.00	0.00	0.02
NC5	ppm	8.79	0.21	0.60	0.26	0.55
NH3	ppm	389.79	0.58	0.47	0.26	0.15
NO	ppm	6.75	2924.83	3543.05	1993.12	69.89
NO2	ppm	0.36	94.67	163.95	111.31	4.77
Soot	mg/m3	14.16	0.01	0.04	0.00	0.00
AFR	:1	11.02	14.48	13.95	14.03	16.74



**Team Results for  
Clean Snowmobile Challenge 2011**

Measurement Accuracy (SAE paper 961804)

H2_XLS %	ModalHC_Dry %	ModalFTIR_H2O %	N2 %	Ar %	AFR :1	Tr_Eff -
1.782	0.106	12.603	78.296	0.905	12.785	1.000
0.000	0.002	12.210	83.717	0.968	16.518	0.892
0.000	0.002	12.545	83.903	0.970	15.943	0.925
0.000	0.002	11.840	82.117	0.949	16.015	0.917
0.000	0.001	10.715	82.618	0.955	18.993	0.770

ModalWHC %	ModalC1 %	ModalC8 %	ModalSUM_HC %	ModalT_Emiss %	ModalError %
126.441	0.106	0.013	0.119	98.131	1.869
1.023	-1.494	-0.187	-1.680	99.577	0.423
0.850	-1.071	-0.134	-1.205	100.163	0.163
0.441	-1.171	-0.146	-1.317	98.022	1.978
0.056	-2.695	-0.337	-3.031	97.397	2.603

# Power Run

TeamNumber	12
TeamName	Clarkson University
Model	CU
Engine	CU

Displacement cc	600cc
RatedSpeed	7182
RatedTorque	48.7

