Team Results for
Clean Snowmobile Challenge 2011

2011 Clean Snowmobile Competition - Lab Emission Event Emission Data Sheet

Test Date :
Team Name : Kettering Univ
Team Number : 5
Model : KU
Engine : KU
Displacement[cc] : 1049cc
100% Speed : 7650
100% Torque : 66.5
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	:	48.6	19.8	11.9	7.9	0.0
HC_m	g/hr	:	17.18	138.67	72.09	0.49	1.21
CO_m	g/hr	:	400.80	16270.03	4966.75	282.26	0.29
NOx_m	g/hr	:	99.84	1.89	1.58	2.20	4.38
Soot_m	mg/hr	:	0.00	0.00	0.00	8.41	0.00
N2O_m	mg/hr	:	0.02	0.04	0.01	0.00	0.00
CO2_m	g/hr	:	87820.90	31941.08	26308.87	26776.31	11477.99
CH4_m	g/hr	:	2.71	59.88	22.86	0.49	1.24
W_HC	g/hr	:	2.06	37.44	18.02	0.15	0.06
W_CO	g/hr	:	48.10	4392.91	1241.69	87.50	0.01
W_NOx	g/hr	:	11.98	0.51	0.40	0.68	0.22
W_HCNOx	g/hr	:	14.04	37.95	18.42	0.83	0.28
W_Soot	mg/hr	:	0.00	0.00	0.00	2.61	0.00
W_N2O	g/hr	:	0.00	0.01	0.00	0.00	0.00
W_CO2	g/hr	:	10538.51	8624.09	6577.22	8300.66	573.90
W_CH4	g/hr	:	0.33	16.17	5.71	0.15	0.06

Total Weighted Power [kW] 16.586

Weighted Emissions

	HC	CO	NOx	HC+NOx
Total Mass [g/hr]	57.74	5770.20	13.79	71.53
Specific Mass [g/kW-hr]	3.48	347.90	0.83	4.31
BSFC [g/kW-hr]	887.9			

Total Soot [mg/hr] 2.61 Specific Soot [mg/kW-hr] 0.16

Not Used for Competition

Total N2O [mg/hr]	0.02	Specific N2O [mg/kW-hr]	0.00
Total CO2 [g/hr]	34614.37	Specific CO2 [g/kW-hr]	2086.99
Total CH4 [g/hr]	22.42	Specific CH4 [g/kW-hr]	1.35

EMISSION TESTS:

	Value	Limit	Result
Power	53.27	<96.94 kW	PASS
Soot	0.16	<100 mg/kW-hr	PASS
CO	347.90	<275 g/kW-hr	FAIL
HC + NOX	4.31	<90 g/kW-hr	PASS
E-Score	120.15	>100	PASS
Valid Data for	All 5 Modes		PASS

LAB EMISSION TEST FAIL

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Modal Raw Data : Engine / Environmental

ModeNum		1	2	3	4	5
Total Points	points	606	1206	1206	1210	1198
PtsInMode	points	606	1206	1206	1210	1201
Speed	rpm	7651.90	6498.54	5749.82	4975.64	2558.30
Torque	Nm	60.62	29.06	19.75	15.14	0.00
Power	kW	48.57	19.77	11.89	7.89	0.00
BSFC	g/kw-hr	577.51	928.66	915.23	1093.84	**
Fuel	g/hr	28050.42	18364.08	10883.67	8627.44	3639.15
T_int	degC	5.39	5.48	5.67	5.85	5.48
RelHumid	%	52.96	49.99	48.03	47.45	45.77
Baro	in Hg	28.98	28.98	28.97	28.97	28.97
Baro	mmHg	736.04	735.99	735.89	735.90	735.78
Pvap_kPa	kPa	0.45	0.43	0.42	0.42	0.39
Pvap_inHg	inHg	0.13	0.13	0.12	0.12	0.12
AbsHumidity	grains/lb	20.16	19.13	18.60	18.57	17.51
SatPres	kPa	97.68	97.69	97.69	97.69	97.70
Hum Factor		0.80	0.79	0.79	0.79	0.79
F_fac		0.97	0.97	0.97	0.97	0.97
K_fac		0.99	0.99	0.99	0.99	0.99
Humidity	g/kg	2.88	2.73	2.66	2.65	2.50
H2		0.03	3.22	1.25	0.07	0.00
WetDry Factor		0.85	0.88	0.87	0.87	0.87

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Modal Emissions Concentrations

ModeNum		1	2	3	4	5
THC	ppmC1	83.47	1209.45	964.19	7.73	42.29
CO	%	0.10	7.07	3.31	0.22	0.00
N2O	ppm	0.25	1.13	0.52	0.07	0.08
CH4	ppm	11.48	455.27	266.53	6.73	37.67
CO2	%	13.52	8.83	11.15	13.37	12.73
O2	%	0.03	0.00	0.00	0.00	1.16
CNOx	ppm	147.04	4.99	6.41	10.52	46.43
AHC	ppm	5.99	47.62	43.04	0.02	0.03
C2H2	ppm	1.62	2.90	0.11	0.18	0.11
C2H4	ppm	3.56	86.61	80.06	0.46	0.99
C3H6	ppm	0.76	11.68	8.27	0.18	0.20
C4H6	ppm	0.30	3.50	5.75	0.44	0.01
ETOH	ppm	0.04	6.28	8.59	2.09	1.15
H2O	%	14.58	12.48	13.10	13.47	12.89
HCHO	ppm	1.45	0.70	0.29	0.12	1.23
HCN	ppm	0.67	7.18	7.14	0.26	0.18
HNCO	ppm	4.75	2.99	7.93	3.72	2.80
MECHO	ppm	0.21	2.14	0.19	0.00	0.01
NC5	ppm	6.63	12.75	13.43	0.06	0.16
NH3	ppm	6.16	106.31	190.76	10.94	0.06
NO	ppm	184.86	5.99	7.72	13.34	58.39
NO2	ppm	0.06	0.31	0.39	0.08	0.59
Soot	mg/m3	0.00	0.00	0.00	0.08	0.00
AFR	:1	12.77	9.84	11.24	12.72	13.61

AVL

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Measurement Accuracy (SAE paper 961804)

H2_XLS %	ModalHC_Dry %	ModalFTIR_H2O %	N2 %	Ar %	AFR :1	Tr_Eff -
0.037	0.010	14.581	86.370	0.998	14.614	0.999
3.676	0.138	12.480	75.761	0.876	11.471	1.000
1.439	0.111	13.096	79.176	0.915	13.052	1.000
0.083	0.001	13.470	83.025	0.960	14.538	1.000
0.000	0.005	12.893	83.286	0.963	15.537	0.941

ModalWHC %	ModalC1 %	ModalC8 %	ModalSUM_HC %	ModalT_Emiss %	ModalError %
17.184	-0.012	-0.002	-0.014	103.385	3.385
138.669	0.138	0.017	0.155	98.632	1.368
72.093	0.111	0.014	0.125	98.294	1.706
0.490	0.000	0.000	0.000	99.780	0.220
1.209	-0.852	-0.107	-0.959	99.235	0.765

Power Run

TeamNumber	5
TeamName	Kettering Univ
Model	KU
Engine	KU

Displacement cc	1049cc
RatedSpeed	7650
RatedTorque	66.5