



Team Results for Clean Snowmobile Challenge 2018 Team 14



2018 Clean Snowmobile Competition - Lab Emission Event Emission Data Sheet

Test Date : 2018/03/08 11:53:44
Team Name : IUPUI
Team Number : 14
Model : Polaris
Engine : Liberty
Displacement[cc] : 799.00
100% Speed : 6850
100% Torque : 78.8
No of Strokes : 4
Fuel : GASOLINE H/C: 2.04 O/C: 0.07

ModeNum	:	1	2	3	4	5
Weighting	:	0.12	0.27	0.25	0.31	0.05
Power	kW	57.5	23.7	14.4	7.0	0.0
HC_m	g/hr	6512.91	2589.44	1617.46	2264.48	1118.96
CO_m	g/hr	3022.52	1820.94	947.40	698.50	331.26
NOx_m	g/hr	376.22	21.07	4.66	1.72	0.04
Soot_m	mg/hr	3629.48	661.99	172.57	54.12	0.49
N2O_m	mg/hr	0.11	0.06	0.03	0.03	0.01
CO2_m	g/hr	34417.44	14589.66	10259.62	4517.63	1267.39
CH4_m	g/hr	43.69	11.60	5.65	3.08	0.51
W_HC	g/hr	781.55	699.15	404.36	701.99	55.95
W_CO	g/hr	362.70	491.65	236.85	216.53	16.56
W_NOx	g/hr	45.15	5.69	1.17	0.53	0.00
W_HCNOx	g/hr	826.70	704.84	405.53	702.52	55.95
W_Soot	mg/hr	435.54	178.74	43.14	16.78	0.02
W_N2O	g/hr	0.01	0.02	0.01	0.01	0.00
W_CO2	g/hr	4130.09	3939.21	2564.90	1400.46	63.37
W_CH4	g/hr	5.24	3.13	1.41	0.96	0.03

Total Weighted Power [kW] 19.038

Weighted Emissions

	HC	CO	NOx	HC+NOx
Total Mass [g/hr]	2643.00	1324.30	52.54	2695.53
Specific Mass [g/kW-hr]	138.83	69.56	2.76	141.58
BSFC [g/kW-hr]	407.2			

Total Soot [mg/hr] 674.22 Specific Soot [mg/kW-hr] 35.41

Not Used for Competition

Total N2O [mg/hr]	0.05	Specific N2O [mg/kW-hr]	0.00
Total CO2 [g/hr]	12098.04	Specific CO2 [g/kW-hr]	635.46
Total CH4 [g/hr]	10.77	Specific CH4 [g/kW-hr]	0.57
RMC BSFC [g/kW-hr]	0		

EMISSION TESTS:

	Value	Limit	Result
Power	56.54	<96.94 kW	PASS
Soot	35.41	<50 mg/kW-hr	PASS
CO	69.56	<275 g/kW-hr	PASS
HC + NOX	141.58	<90 g/kW-hr	FAIL
E-Score	98.22	>175	FAIL
Valid Data for All 5 Modes			PASS
RMC			FAIL (-50 Points)
LAB EMISSION TEST			FAIL



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Modal Raw Data : Engine / Environmental

ModeNum		1	2	3	4	5
Total Points	points	150	200	200	150	100
PtsInMode	points	150	200	300	150	200
Speed	rpm	6841.82	5828.40	5131.34	3959.62	1891.71
Torque	Nm	80.23	38.79	26.73	16.78	0.00
Power	kW	57.48	23.68	14.36	6.96	0.00
BSFC	g/kw-hr	331.10	344.94	374.10	583.33	**
Fuel	g/hr	19032.06	8167.39	5372.64	4059.29	1690.43
T_int	degC	12.63	13.74	14.47	11.74	13.52
RelHumid	%	39.59	39.04	37.97	42.31	37.70
Baro	in Hg	28.84	28.84	28.84	28.84	28.84
Baro	mmHg	732.56	732.51	732.52	732.55	732.50
Pvap_kPa	kPa	0.52	0.54	0.55	0.53	0.52
Pvap_inHg	inHg	0.15	0.16	0.16	0.16	0.15
AbsHumidity	grains/lb	23.27	24.46	24.81	23.62	23.32
SatPres	kPa	97.15	97.11	97.11	97.14	97.14
Hum Factor		0.80	0.81	0.81	0.81	0.80
F_fac		0.99	0.99	0.99	0.99	0.99
K_fac		1.01	1.01	1.01	1.01	1.01
Humidity	g/kg	3.32	3.49	3.54	3.37	3.33
H2		0.38	0.51	0.39	0.48	0.81
WetDry Factor		0.91	0.92	0.91	0.93	0.93



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Modal Emissions Concentrations

ModeNum		1	2	3	4	5
THC	ppmC1	43997.54	37545.53	35818.38	78926.60	128859.48
CO	%	1.03	1.33	1.05	1.22	1.92
N2O	ppm	2.30	2.71	2.19	3.11	4.85
CH4	ppm	259.51	147.93	110.00	94.51	51.61
CO2	%	7.43	6.76	7.26	5.03	4.67
O2	%	7.93	8.52	7.81	11.38	10.56
CNOx	ppm	777.15	93.41	31.57	18.35	1.42
AHC	ppm	322.85	429.72	413.71	733.37	174.38
C2H2	ppm	124.44	95.10	70.98	180.32	326.08
C2H4	ppm	1288.66	281.54	204.63	295.11	428.41
C3H6	ppm	463.16	149.67	109.31	148.26	203.05
C4H6	ppm	30.65	12.03	9.43	26.00	47.00
ETOH	ppm	586.79	730.12	743.87	1702.64	2975.92
H2O	%	9.03	8.39	8.69	6.74	6.80
HCHO	ppm	770.50	159.02	106.97	136.96	126.37
HCN	ppm	27.96	4.10	2.00	1.81	2.50
HNCO	ppm	27.47	2.75	0.00	0.00	0.00
MECHO	ppm	387.93	102.72	74.57	265.94	59.63
NC5	ppm	648.00	1011.31	1026.79	2741.23	4794.80
NH3	ppm	3.25	0.00	0.00	0.00	0.00
NO	ppm	911.27	101.84	35.96	20.51	0.86
NO2	ppm	54.81	13.75	3.06	2.50	0.93
Soot	mg/m3	14.08	5.58	2.24	1.08	0.03
AFR	:1	8.12	9.03	9.08	5.77	3.55



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Measurement Accuracy (SAE paper 961804)

ModeNum	H2_XLS %	ModalHC_Dry %	ModalFTIR_H2O %	N2 %	Ar %	AFR :1	Tr_Eff -
1	0.417	4.836	9.030	81.895	0.947	15.306	0.598
2	0.553	4.098	8.387	80.373	0.929	16.443	0.570
3	0.429	3.923	8.692	79.731	0.922	16.215	0.605
4	0.513	8.463	6.744	80.446	0.930	13.865	0.419
5	0.867	13.826	6.801	77.250	0.893	9.665	0.445

ModeNum	ModalWHC %	ModalC1 %	ModalC8 %	ModalSUM_HC %	ModalT_Emiss %	ModalError %
1	6512.912	-0.847	-0.106	-0.953	100.423	0.423
2	2589.438	-1.466	-0.183	-1.649	98.347	1.653
3	1617.456	-1.223	-0.153	-1.375	97.372	2.628
4	2264.480	-0.349	-0.044	-0.392	100.406	0.406
5	1118.955	2.234	0.279	2.514	99.918	0.082

Carbon Balance Verification

		1	2	3	4	5
Power	kW	57.482	23.677	14.361	6.959	0.000
BSFC	g/kw-hr	331.10	344.94	374.10	583.33	**
Fuel_MassFlow	g/hr	19032	8167	5373	4059	1690
HC_m	g/hr	6512.9	2589.4	1617.5	2264.5	1119.0
CO_m	g/hr	3022.5	1820.9	947.4	698.5	331.3
CO2_m	g/hr	34417	14590	10260	4518	1267
TW_Power	kW	19.038				
TW_BSFC	g/kw-hr	407.22				
Fuel_MassFlow	g/hr	19032	8167	5373	4059	1690
FuelCalc	g/hr	21751	9296	6099	4801	2032
FuelCalcDev	%	-14.285	-13.820	-13.524	-18.271	-20.195

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

Power Run

Team 14

TeamNumber	14
TeamName	IUPUI
Model	Polaris
Engine	Liberty

Displacement cc	799.00
RatedSpeed	6850
RatedTorque	78.8

