



Team Results for Clean Snowmobile Challenge 2019 Team 7



2019 Clean Snowmobile Competition - Lab Emission Event Emission Data Sheet

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Test Date       : 2019/03/06 16:34:55
Team Name      : Idaho
Team Number    : 7
Model         : ETec
Engine        : ETec
Displacement[cc] : 850.00
100% Speed    : 6843
100% Torque   : 109.5
No of Strokes : 2
Fuel          : Gas
                H/C: 1.95      O/C: 0.00
  
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ModeNum	:	1	2	3	4	5	RMC
Weighting	:	0.12	0.27	0.25	0.31	0.05	1.00
Power	kW :	69.7	34.1	19.4	9.7	0.0	24.9
HC_m	g/hr :	2768.41	379.05	132.58	77.96	39.17	142.64
CO_m	g/hr :	16285.20	1626.48	101.66	12.14	6.04	1292.28
NOx_m	g/hr :	101.99	31.53	54.45	6.00	0.98	56.03
Soot_m	mg/hr:	1898.04	347.00	238.59	6.96	86.81	365.28
N2O_m	mg/hr:	0.49	0.04	0.01	0.01	0.00	0.05
CO2_m	g/hr :	49291.69	30137.04	17818.61	10619.12	3281.74	26523.22
CH4_m	g/hr :	119.36	13.26	5.99	1.59	0.28	14.11
W_HC	g/hr :	332.21	102.34	33.15	24.17	1.96	142.64
W_CO	g/hr :	1954.22	439.15	25.42	3.76	0.30	1292.28
W_NOx	g/hr :	12.24	8.51	13.61	1.86	0.05	56.03
W_HCNOx	g/hr :	344.45	110.85	46.76	26.03	2.01	198.67
W_Soot	mg/hr:	227.76	93.69	59.65	2.16	4.34	365.28
W_N2O	g/hr :	0.06	0.01	0.00	0.00	0.00	0.05
W_CO2	g/hr :	5915.00	8137.00	4454.65	3291.93	164.09	26523.22
W_CH4	g/hr :	14.32	3.58	1.50	0.49	0.01	14.11

Total Weighted Power [kW] 25.410

Weighted Emissions

	HC	CO	NOx	HC+NOx
Total Mass [g/hr]	493.83	2422.86	36.27	530.10
Specific Mass [g/kW-hr]	19.43	95.35	1.43	20.86
BSFC [g/kW-hr]	317.1			

Total Soot [mg/hr] 387.60 Specific Soot [mg/kW-hr] 15.25

Not Used for Competition

Total N2O [mg/hr]	0.08	Specific N2O [mg/kW-hr]	0.00
Total CO2 [g/hr]	21962.67	Specific CO2 [g/kW-hr]	864.34
Total CH4 [g/hr]	19.91	Specific CH4 [g/kW-hr]	0.78
RMC BSFC [g/kW-hr]	370.15		

EMISSION TESTS:

	Value	Limit	Result
Power	78.50	<96.94 kW	PASS
Soot	15.25	<50 mg/kW-hr	PASS
CO	95.35	<275 g/kW-hr	PASS
HC + NOX	20.86	<90 g/kW-hr	PASS
E-Score	172.25	>175	FAIL
Valid Data for All 5 Modes			PASS
RMC			PASS
LAB EMISSION TEST			FAIL



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Modal Raw Data : Engine / Environmental

ModeNum		1	2	3	4	5	RMC
Total Points	points	600	1520	1200	1200	1200	11432
PtsInMode	points	1210	3370	3470	1800	1480	11432
Speed	rpm	6843.92	5816.40	5132.37	4448.85	1198.36	5178.75
Torque	Nm	97.19	55.93	36.15	20.74	0.00	45.88
Power	kW	69.66	34.07	19.43	9.66	0.00	24.88
BSFC	g/kw-hr	381.11	315.85	300.65	357.74	**	370.15
Fuel	g/hr	26546.73	10760.75	5841.70	3456.18	1084.31	9210.00
T_int	degC	32.67	24.59	20.49	22.07	18.83	23.72
RelHumid	%	12.98	19.85	20.47	16.59	20.37	17.89
Baro	in Hg	28.91	28.92	28.92	28.91	28.92	28.91
Baro	mmHg	734.26	734.53	734.53	734.36	734.56	734.44
Pvap_kPa	kPa	0.50	0.50	0.42	0.37	0.38	0.43
Pvap_inHg	inHg	0.15	0.15	0.12	0.11	0.11	0.13
AbsHumidity	grains/lb	22.46	22.58	18.65	16.46	16.92	19.41
SatPres	kPa	97.39	97.42	97.51	97.54	97.55	97.48
Hum Factor		1.00	1.00	1.00	1.00	1.00	1.00
F_fac		1.04	1.02	1.00	1.01	1.00	1.01
K_fac		1.04	1.03	1.02	1.02	1.02	1.03
Humidity	g/kg	3.21	3.23	2.66	2.35	2.42	2.77
H2		1.98	0.36	0.03	0.01	0.01	0.29
WetDry Factor		0.86	0.87	0.89	0.90	0.93	1.00



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Modal Emissions Concentrations

ModeNum		1	2	3	4	5	RMC
THC	ppmC1	16016.25	4950.37	2654.08	2412.59	2634.63	1877.89
CO	%	4.70	1.06	0.10	0.02	0.02	0.85
N2O	ppm	8.93	1.81	0.88	0.85	0.67	2.13
CH4	ppm	603.16	151.29	104.68	43.05	16.65	162.30
CO2	%	9.06	12.50	11.33	10.44	7.01	11.09
O2	%	0.33	0.15	3.23	4.65	9.86	2.82
CNOx	ppm	179.25	125.08	331.15	56.43	20.09	224.07
AHC	ppm	197.51	51.60	8.41	5.40	20.54	52.73
C2H2	ppm	51.38	11.25	3.96	1.38	1.94	11.75
C2H4	ppm	376.75	93.31	28.03	15.10	7.05	86.64
C3H6	ppm	224.06	72.77	11.63	9.62	4.93	56.62
C4H6	ppm	20.64	8.43	0.08	0.07	0.16	4.29
ETOH	ppm	4.85	3.79	2.44	2.31	1.73	5.66
H2O	%	13.93	13.22	11.04	10.19	6.80	0.00
HCHO	ppm	76.55	19.17	22.89	17.96	10.12	29.76
HCN	ppm	6.73	2.93	0.29	0.27	0.10	1.91
HNCO	ppm	16.91	3.92	1.95	1.38	0.49	4.62
MECHO	ppm	28.72	6.15	4.40	4.63	2.67	10.19
NC5	ppm	46.08	29.39	72.12	88.09	102.55	83.39
NH3	ppm	36.50	21.48	1.02	3.57	0.55	11.01
NO	ppm	179.30	125.65	320.28	53.73	16.48	219.46
NO2	ppm	0.20	0.02	10.87	2.70	3.62	4.81
Soot	mg/m3	6.98	2.62	2.72	0.12	3.38	2.75
AFR	:1	9.40	12.92	16.33	17.87	25.69	15.86



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Measurement Accuracy (SAE paper 961804)

ModeNum	H2_XLS %	ModalHC_Dry %	ModalFTIR_H2O %	N2 %	Ar %	AFR :1	Tr_Eff -
1	2.298	1.861	13.935	76.675	0.886	11.298	0.983
2	0.419	0.570	13.219	81.123	0.938	13.792	0.992
3	0.037	0.298	11.040	81.708	0.944	17.035	0.837
4	0.007	0.269	10.186	81.475	0.942	18.630	0.767
5	0.007	0.283	6.801	80.050	0.925	27.481	0.513

ModeNum	ModalWHC %	ModalC1 %	ModalC8 %	ModalSUM_HC %	ModalT_Emiss %	ModalError %
1	2768.414	1.558	0.195	1.752	97.997	2.003
2	379.047	0.443	0.055	0.499	98.794	1.206
3	132.584	-1.845	-0.231	-2.076	97.134	2.866
4	77.964	-2.509	-0.314	-2.823	96.423	3.577
5	39.166	-3.527	-0.441	-3.968	95.144	4.856

Carbon Balance Verification

		1	2	3	4	5	6
Power	kW	69.656	34.069	19.430	9.661	0.000	24.882
BSFC	g/kw-hr	381.11	315.85	300.65	357.74	**	370.15
Fuel_MassFlow	g/hr	26547	10761	5842	3456	1084	9210
HC_m	g/hr	2768.4	379.0	132.6	78.0	39.2	142.6
CO_m	g/hr	16285	1626	102	12	6	1292
CO2_m	g/hr	49292	30137	17819	10619	3282	26523
TW_Power	kW	25.410					
TW_BSFC	g/kw-hr	317.08					
Fuel_MassFlow	g/hr	26547	10761	5842	3456	1084	9210
FuelCalc	g/hr	26999	10823	5863	3469	1091	9233
FuelCalcDev	%	-1.7036	-0.5742	-0.3694	-0.3671	-0.5890	-0.2514

\$HCR_ENG	1.949
\$OCR_ENG	0
MassFracCFuel H/C ratio	0.85943

Power Run

Team 7

TeamNumber	7
TeamName	Idaho
Model	ETec
Engine	ETec

Displacement cc	850.00
RatedSpeed	6843
RatedTorque	109.5

