



Team Results for Clean Snowmobile Challenge 2018 Team 101



2018 Clean Snowmobile Competition - Lab Emission Event Emission Data Sheet

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Test Date       : 2018/03/05 16:11:26
Team Name      : ETS
Team Number    : 101
Model         : Kohler
Engine        :
Displacement[cc] : 1028.00
100% Speed    : 3597
100% Torque   : 74.6
No of Strokes : 4
Fuel          : Diesel
                H/C: 1.74      O/C: 0.01
  
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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 :	26.6	12.2	6.6	3.5	0.0	8.9
HC_m	g/hr :	0.92	0.04	1.87	0.53	0.49	0.31
CO_m	g/hr :	0.77	0.07	0.29	0.13	1.45	0.44
NOx_m	g/hr :	71.94	55.02	37.72	29.57	20.01	50.74
Soot_m	mg/hr:	3466.93	620.29	99.37	32.29	41.85	585.43
N2O_m	mg/hr:	0.04	0.02	0.02	0.02	0.00	0.03
CO2_m	g/hr :	15026.25	9128.57	5265.74	3181.56	1359.78	7583.39
CH4_m	g/hr :	0.04	0.04	0.05	0.07	0.03	0.06
W_HC	g/hr :	0.11	0.01	0.47	0.16	0.02	0.31
W_CO	g/hr :	0.09	0.02	0.07	0.04	0.07	0.44
W_NOx	g/hr :	8.63	14.86	9.43	9.17	1.00	50.74
W_HCNOx	g/hr :	8.74	14.87	9.90	9.33	1.02	51.04
W_Soot	mg/hr:	416.03	167.48	24.84	10.01	2.09	585.43
W_N2O	g/hr :	0.00	0.01	0.01	0.01	0.00	0.03
W_CO2	g/hr :	1803.15	2464.71	1316.44	986.28	67.99	7583.39
W_CH4	g/hr :	0.01	0.01	0.01	0.02	0.00	0.06

Total Weighted Power [kW] 9.205

Weighted Emissions

	HC	CO	NOx	HC+NOx
Total Mass [g/hr]	0.77	0.30	43.09	43.86
Specific Mass [g/kW-hr]	0.08	0.03	4.68	4.76
BSFC [g/kW-hr]	236.2			

Total Soot [mg/hr] 620.45 Specific Soot [mg/kW-hr] 67.41

Not Used for Competition

Total N2O [mg/hr]	0.02	Specific N2O [mg/kW-hr]	0.00
Total CO2 [g/hr]	6638.57	Specific CO2 [g/kW-hr]	721.22
Total CH4 [g/hr]	0.05	Specific CH4 [g/kW-hr]	0.01
RMC BSFC [g/kW-hr]	267.22		

EMISSION TESTS:

	Value	Limit	Result
Power	28.09	<96.94 kW	PASS
Soot	67.41	<50 mg/kW-hr	FAIL
CO	0.03	<275 g/kW-hr	PASS
HC + NOX	4.76	<90 g/kW-hr	PASS
E-Score	206.82	>175	PASS
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	828	1520	1200	1200	1200	11432
PtsInMode	points	2048	3370	3470	1800	1480	11432
Speed	rpm	3596.65	3056.31	2694.84	2338.81	1106.55	2761.38
Torque	Nm	70.75	38.02	23.37	14.13	0.00	30.69
Power	kW	26.65	12.17	6.59	3.46	0.00	8.88
BSFC	g/kw-hr	176.35	234.58	249.97	287.63	**	267.22
Fuel	g/hr	4699.66	2854.36	1648.48	995.39	426.37	2371.67
T_int	degC	1.19	1.25	1.11	1.25	1.09	1.20
RelHumid	%	19.18	19.19	19.42	19.63	19.42	19.38
Baro	in Hg	29.01	29.01	29.00	29.01	29.00	29.01
Baro	mmHg	736.91	736.73	736.69	736.85	736.60	736.77
Pvap_kPa	kPa	0.13	0.13	0.13	0.13	0.13	0.13
Pvap_inHg	inHg	0.04	0.04	0.04	0.04	0.04	0.04
AbsHumidity	grains/lb	5.61	5.63	5.65	5.76	5.64	5.67
SatPres	kPa	98.12	98.10	98.09	98.11	98.08	98.10
Hum Factor		0.75	0.75	0.75	0.75	0.75	0.75
F_fac		0.95	0.95	0.95	0.95	0.95	0.95
K_fac		0.98	0.98	0.98	0.98	0.98	0.98
Humidity	g/kg	0.80	0.80	0.81	0.82	0.81	0.81
H2		0.00	0.00	0.00	0.00	0.00	0.00
WetDry Factor		0.92	0.95	0.96	0.97	0.97	1.00



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Modal Emissions Concentrations

ModeNum		1	2	3	4	5	RMC
THC	ppmC1	15.85	0.73	45.86	13.31	25.08	5.95
CO	%	0.00	0.00	0.00	0.00	0.00	0.00
N2O	ppm	1.95	1.52	1.55	1.51	0.78	1.65
CH4	ppm	0.63	0.68	1.06	1.52	1.11	0.96
CO2	%	8.07	5.61	4.05	2.52	2.18	4.62
O2	%	8.47	12.22	14.61	16.19	16.86	14.18
CNOx	ppm	369.50	323.43	277.34	223.62	307.36	295.58
AHC	ppm	0.27	0.34	1.50	0.88	1.28	0.86
C2H2	ppm	0.04	0.09	0.17	0.10	0.20	0.11
C2H4	ppm	0.52	0.79	3.04	1.29	1.54	1.50
C3H6	ppm	0.29	0.47	0.51	0.46	0.71	0.46
C4H6	ppm	0.78	0.44	0.23	0.31	0.29	0.39
ETOH	ppm	0.49	0.58	0.54	0.37	0.20	0.51
H2O	%	7.58	5.39	3.98	3.09	2.61	0.00
HCHO	ppm	2.22	1.20	2.94	1.03	1.73	1.73
HCN	ppm	0.64	0.27	0.08	0.12	0.05	0.21
HNCO	ppm	3.13	2.02	1.64	1.82	1.40	1.97
MECHO	ppm	0.00	0.00	0.01	0.00	0.00	0.00
NC5	ppm	1.00	0.91	2.26	1.41	1.44	1.43
NH3	ppm	0.48	0.05	0.02	0.13	0.02	0.11
NO	ppm	354.39	333.41	358.93	258.06	402.27	329.61
NO2	ppm	135.62	95.47	8.77	38.31	5.28	62.26
Soot	mg/m3	34.22	7.02	1.41	0.49	1.27	6.43
AFR	:1	24.65	35.89	49.97	78.13	90.61	44.75



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Measurement Accuracy (SAE paper 961804)

ModeNum	H2_XLS %	ModalHC_Dry %	ModalFTIR_H2O %	N2 %	Ar %	AFR :1	Tr_Eff -
1	0.000	0.002	7.582	80.749	0.933	24.917	0.581
2	0.000	0.000	5.389	80.194	0.927	36.241	0.402
3	0.000	0.005	3.976	79.750	0.922	50.551	0.290
4	0.000	0.001	3.089	77.606	0.897	78.907	0.219
5	0.001	0.003	2.609	77.681	0.898	91.630	0.188

ModeNum	ModalWHC %	ModalC1 %	ModalC8 %	ModalSUM_HC %	ModalT_Emiss %	ModalError %
1	0.923	-3.659	-0.457	-4.117	95.509	4.491
2	0.037	-3.544	-0.443	-3.987	96.020	3.980
3	1.866	-2.989	-0.374	-3.363	96.778	3.222
4	0.526	-2.026	-0.253	-2.280	95.557	4.443
5	0.488	-1.822	-0.228	-2.050	96.130	3.870

Carbon Balance Verification

		1	2	3	4	5	6
Power	kW	26.649	12.168	6.595	3.461	0.000	8.875
BSFC	g/kw-hr	176.35	234.58	249.97	287.63	**	267.22
Fuel_MassFlow	g/hr	4699.7	2854.4	1648.5	995.4	426.4	2371.7
HC_m	g/hr	0.9229	0.0374	1.8658	0.5265	0.4884	0.3055
CO_m	g/hr	0.7702	0.0735	0.2883	0.1331	1.4495	0.4365
CO2_m	g/hr	15026	9129	5266	3182	1360	7583
TW_Power	kW	9.2047					
TW_BSFC	g/kw-hr	236.16					
Fuel_MassFlow	g/hr	4699.7	2854.4	1648.5	995.4	426.4	2371.7
FuelCalc	g/hr	4748.9	2884.2	1666.0	1005.9	430.9	2396.5
FuelCalcDev	%	-1.0475	-1.0448	-1.0613	-1.0524	-1.0615	-1.0465

\$HCR_ENG	1.736
\$OCR_ENG	0.009
MassFracCFuel H/C ratio	0.86380

Power Run

Team 101

TeamNumber	101
TeamName	ETS
Model	Kohler
Engine	

Displacement cc	1028.00
RatedSpeed	3597
RatedTorque	74.6

