



Team Results for Clean Snowmobile Challenge 2019 Team 103



2019 Clean Snowmobile Competition - Lab Emission Event Emission Data Sheet

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Test Date       : 2019/03/08 14:23:27
Team Name      : ETS
Team Number    : 103
Model         : Kohler
Engine        : KDW
Displacement[cc] : 1003.00
100% Speed    : 4152
100% Torque   : 65.4
No of Strokes : 4
Fuel          : Diesel
                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 :	24.8	12.4	7.0	3.5	0.0	8.4
HC_m	g/hr :	0.03	0.00	0.04	0.00	0.00	-0.10
CO_m	g/hr :	0.71	0.12	0.23	0.02	0.13	0.60
NOx_m	g/hr :	134.19	81.94	56.89	42.10	25.94	70.55
Soot_m	mg/hr:	6854.87	3116.46	1008.39	243.22	101.22	1907.24
N2O_m	mg/hr:	0.04	0.02	0.02	0.01	0.00	0.02
CO2_m	g/hr :	23226.13	11759.89	7625.41	4743.40	1292.53	9438.81
CH4_m	g/hr :	0.07	0.05	0.05	0.04	0.02	0.06
W_HC	g/hr :	0.00	0.00	0.01	0.00	0.00	-0.10
W_CO	g/hr :	0.09	0.03	0.06	0.01	0.01	0.60
W_NOx	g/hr :	16.10	22.12	14.22	13.05	1.30	70.55
W_HCNOx	g/hr :	16.11	22.12	14.23	13.05	1.30	70.45
W_Soot	mg/hr:	822.58	841.44	252.10	75.40	5.06	1907.24
W_N2O	g/hr :	0.01	0.01	0.00	0.00	0.00	0.02
W_CO2	g/hr :	2787.14	3175.17	1906.35	1470.45	64.63	9438.81
W_CH4	g/hr :	0.01	0.01	0.01	0.01	0.00	0.06

Total Weighted Power [kW] 9.156

Weighted Emissions

	HC	CO	NOx	HC+NOx
Total Mass [g/hr]	0.01	0.19	66.80	66.81
Specific Mass [g/kW-hr]	0.00	0.02	7.30	7.30
BSFC [g/kW-hr]	336.6			

Total Soot [mg/hr] 1996.59 Specific Soot [mg/kW-hr] 218.06

Not Used for Competition

Total N2O [mg/hr]	0.02	Specific N2O [mg/kW-hr]	0.00
Total CO2 [g/hr]	9403.74	Specific CO2 [g/kW-hr]	1027.07
Total CH4 [g/hr]	0.05	Specific CH4 [g/kW-hr]	0.01
RMC BSFC [g/kW-hr]	356.73		

EMISSION TESTS:

	Value	Limit	Result
Power	28.44	<96.94 kW	PASS
Soot	218.06	<50 mg/kW-hr	FAIL
CO	0.02	<275 g/kW-hr	PASS
HC + NOX	7.30	<90 g/kW-hr	PASS
E-Score	205.13	>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	600	1520	1200	1200	1200	11432
PtsInMode	points	1210	3370	3470	1800	1480	11432
Speed	rpm	4150.09	3532.86	3114.07	2698.00	826.84	3159.50
Torque	Nm	56.98	33.41	21.61	12.39	0.00	25.40
Power	kW	24.76	12.36	7.05	3.50	0.00	8.40
BSFC	g/kw-hr	297.84	302.16	343.65	430.20	**	356.73
Fuel	g/hr	7375.95	3734.47	2421.65	1506.30	410.52	2997.54
T_int	degC	27.23	28.80	27.51	29.69	26.01	28.30
RelHumid	%	17.49	17.02	16.42	17.07	16.59	16.77
Baro	in Hg	28.91	28.91	28.91	28.91	28.91	28.91
Baro	mmHg	734.36	734.32	734.30	734.36	734.31	734.34
Pvap_kPa	kPa	0.51	0.54	0.49	0.57	0.45	0.52
Pvap_inHg	inHg	0.15	0.16	0.14	0.17	0.13	0.15
AbsHumidity	grains/lb	22.88	24.16	21.79	25.37	20.34	23.19
SatPres	kPa	97.39	97.36	97.41	97.34	97.44	97.38
Hum Factor		0.80	0.81	0.80	0.81	0.80	0.80
F_fac		1.02	1.03	1.02	1.03	1.02	1.02
K_fac		1.03	1.04	1.03	1.04	1.03	1.03
Humidity	g/kg	3.27	3.45	3.11	3.62	2.91	3.31
H2		0.00	0.00	0.00	0.00	0.00	0.00
WetDry Factor		0.92	0.94	0.95	0.96	0.97	1.00



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Modal Emissions Concentrations

ModeNum		1	2	3	4	5	RMC
THC	ppmC1	0.30	0.00	0.94	0.05	0.00	-1.76
CO	%	0.00	0.00	0.00	0.00	0.00	0.00
N2O	ppm	1.48	1.27	1.30	1.08	0.65	1.21
CH4	ppm	0.70	0.77	0.98	1.07	1.07	0.91
CO2	%	8.10	6.16	5.08	4.16	2.64	5.13
O2	%	8.30	11.24	12.84	14.17	15.74	12.44
CNOx	ppm	447.73	410.35	362.67	353.37	507.61	366.46
AHC	ppm	0.59	0.60	0.52	0.57	0.44	0.56
C2H2	ppm	0.11	0.18	0.32	0.24	0.42	0.24
C2H4	ppm	0.68	0.55	1.62	1.02	1.00	0.99
C3H6	ppm	0.39	0.32	0.29	0.28	0.34	0.34
C4H6	ppm	0.46	0.22	0.11	0.10	0.09	0.15
ETOH	ppm	1.01	0.73	0.71	0.70	0.63	0.68
H2O	%	7.91	6.01	4.97	4.37	3.13	0.00
HCHO	ppm	1.33	0.91	1.79	1.29	1.32	1.28
HCN	ppm	0.21	0.13	0.04	0.04	0.02	0.07
HNCO	ppm	2.23	1.81	1.26	1.46	1.36	1.59
MECHO	ppm	0.00	0.00	0.00	0.00	0.00	0.00
NC5	ppm	1.15	0.95	1.28	0.84	0.93	1.03
NH3	ppm	0.03	0.00	0.00	0.02	0.00	0.01
NO	ppm	394.77	393.76	427.64	384.78	624.86	388.70
NO2	ppm	162.59	114.48	25.85	51.20	13.21	67.03
Soot	mg/m3	43.27	29.74	12.31	3.94	3.98	19.28
AFR	:1	24.87	32.80	39.74	48.43	73.67	38.76



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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	0.000	7.914	81.086	0.937	24.824	0.589
2	0.000	0.000	6.014	80.126	0.926	32.735	0.449
3	0.000	0.000	4.973	79.500	0.919	39.664	0.373
4	0.000	0.000	4.369	79.515	0.919	48.334	0.311
5	0.000	0.000	3.133	76.541	0.885	73.526	0.240

ModeNum	ModalWHC %	ModalC1 %	ModalC8 %	ModalSUM_HC %	ModalT_Emiss %	ModalError %
1	0.027	-3.617	-0.452	-4.069	95.825	4.175
2	0.000	**	**	**	**	**
3	0.045	-3.352	-0.419	-3.771	95.556	4.444
4	0.002	-2.997	-0.375	-3.371	96.275	3.725
5	0.000	**	**	**	**	**

Carbon Balance Verification

		1	2	3	4	5	6
Power	kW	24.765	12.359	7.047	3.501	0.000	8.403
BSFC	g/kw-hr	297.84	302.16	343.65	430.20	**	356.73
Fuel_MassFlow	g/hr	7376.0	3734.5	2421.6	1506.3	410.5	2997.5
HC_m	g/hr	0.02690	0.00000	0.04464	0.00188	0.00000	-0.10322
CO_m	g/hr	0.71329	0.12304	0.23433	0.02288	0.13311	0.59754
CO2_m	g/hr	23226	11760	7625	4743	1293	9439
TW_Power	kW	9.1559					
TW_BSFC	g/kw-hr	336.60					
Fuel_MassFlow	g/hr	7376.0	3734.5	2421.6	1506.3	410.5	2997.5
FuelCalc	g/hr	7375.8	3734.4	2421.6	1506.3	410.5	2997.5
FuelCalcDev	%	0.0017877	0.0018473	0.0015458	0.0018268	0.0018475	0.0024107

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

Power Run

Team 103

TeamNumber	103
TeamName	ETS
Model	Kohler
Engine	KDW

Displacement cc	1003.00
RatedSpeed	4152
RatedTorque	65.4

