



Team Results for Clean Snowmobile Challenge 2017 Team 101



2017 Clean Snowmobile Competition - Lab Emission Event Emission Data Sheet

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Test Date       : 2017/03/10 09:58:45
Team Name      : North Dakota
Team Number    : 101
Model         : Yanmar
Engine        : Yanmar
Displacement[cc] : 904.00
100% Speed    : 3642
100% Torque   : 80.2
No of Strokes : 4
Fuel          : Gasoline           H/C: 1.79       O/C: 0.03
  
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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	:	29.5	13.3	7.6	3.8	0.0	8.9
HC_m g/hr	:	7.05	1.25	1.30	1.40	0.57	0.61
CO_m g/hr	:	0.40	0.67	0.84	0.76	0.90	0.85
NOx_m g/hr	:	100.03	66.04	40.14	27.31	17.22	51.27
Soot_m mg/hr	:	3194.37	271.94	176.27	84.68	41.83	386.43
N2O_m mg/hr	:	0.04	0.04	0.06	0.04	0.01	0.06
CO2_m g/hr	:	28118.03	12063.56	7760.03	4783.01	1520.47	9788.34
CH4_m g/hr	:	3.59	0.16	0.16	0.19	0.07	0.39
W_HC g/hr	:	0.85	0.34	0.33	0.43	0.03	0.61
W_CO g/hr	:	0.05	0.18	0.21	0.23	0.05	0.85
W_NOx g/hr	:	12.00	17.83	10.04	8.47	0.86	51.27
W_HCNOx g/hr	:	12.85	18.17	10.36	8.90	0.89	51.88
W_Soot mg/hr	:	383.32	73.42	44.07	26.25	2.09	386.43
W_N2O g/hr	:	0.01	0.01	0.01	0.01	0.00	0.06
W_CO2 g/hr	:	3374.16	3257.16	1940.01	1482.73	76.02	9788.34
W_CH4 g/hr	:	0.43	0.04	0.04	0.06	0.00	0.39

Total Weighted Power [kW] 10.183

Weighted Emissions

	HC	CO	NOx	HC+NOx
Total Mass [g/hr]	1.97	0.72	49.20	51.17
Specific Mass [g/kW-hr]	0.19	0.07	4.83	5.03
BSFC [g/kW-hr]	317.1			

Total Soot [mg/hr] 529.16 Specific Soot [mg/kW-hr] 51.97

Not Used for Competition

Total N2O [mg/hr]	0.05	Specific N2O [mg/kW-hr]	0.00
Total CO2 [g/hr]	10130.09	Specific CO2 [g/kW-hr]	994.85
Total CH4 [g/hr]	0.58	Specific CH4 [g/kW-hr]	0.06
RMC BSFC [g/kW-hr]	347.25		

EMISSION TESTS:

	Value	Limit	Result
Power	30.59	<96.94 kW	PASS
Soot	51.97	<50 mg/kW-hr	FAIL
CO	0.07	<275 g/kW-hr	PASS
HC + NOX	5.03	<90 g/kW-hr	PASS
E-Score	206.63	>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	1200	1200	1200	1200	12031
PtsInMode	points	1210	3050	5251	3470	1480	12031
Speed	rpm	3641.42	3096.75	2725.13	2368.00	1103.67	2729.96
Torque	Nm	77.40	40.87	26.50	15.24	0.00	30.97
Power	kW	29.51	13.25	7.56	3.78	0.00	8.85
BSFC	g/kw-hr	299.41	285.96	322.47	397.79	**	347.25
Fuel	g/hr	8837.09	3789.87	2438.59	1503.77	478.48	3074.84
T_int	degC	17.73	15.63	15.38	19.65	19.01	16.81
RelHumid	%	11.90	12.19	12.46	12.01	12.52	12.15
Baro	in Hg	29.28	29.27	29.27	29.28	29.27	29.28
Baro	mmHg	743.76	743.56	743.55	743.69	743.52	743.64
Pvap_kPa	kPa	0.21	0.19	0.19	0.23	0.24	0.20
Pvap_inHg	inHg	0.06	0.06	0.06	0.07	0.07	0.06
AbsHumidity	grains/lb	9.17	8.35	8.42	10.30	10.37	8.89
SatPres	kPa	98.95	98.94	98.94	98.92	98.89	98.94
Hum Factor		0.76	0.76	0.76	0.77	0.77	0.76
F_fac		0.98	0.98	0.98	0.99	0.99	0.98
K_fac		1.00	1.00	1.00	1.01	1.01	1.00
Humidity	g/kg	1.31	1.19	1.20	1.47	1.48	1.27
H2		0.00	0.00	0.00	0.00	0.00	0.00
WetDry Factor		0.90	0.93	0.94	0.96	0.97	1.00



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Modal Emissions Concentrations

ModeNum		1	2	3	4	5	RMC
THC	ppmC1	82.55	23.92	30.71	40.74	30.01	12.01
CO	%	0.00	0.00	0.00	0.00	0.00	0.00
N2O	ppm	1.64	2.66	4.31	3.91	2.34	3.48
CH4	ppm	36.32	2.65	3.28	4.83	3.29	6.68
CO2	%	10.34	7.27	5.74	4.36	2.53	6.04
O2	%	4.77	9.44	11.78	13.77	15.94	11.90
CNOx	ppm	351.99	380.76	283.92	238.29	274.17	302.61
AHC	ppm	1.45	1.77	2.00	2.43	2.54	2.10
C2H2	ppm	0.86	0.61	0.62	0.61	0.48	0.58
C2H4	ppm	7.65	3.87	6.34	7.55	5.59	5.09
C3H6	ppm	0.98	0.76	1.14	1.08	1.07	1.06
C4H6	ppm	0.81	0.77	0.79	0.71	0.65	0.82
ETOH	ppm	0.00	0.00	0.00	0.00	0.00	0.00
H2O	%	10.21	7.23	5.72	4.44	3.02	0.00
HCHO	ppm	2.03	2.86	3.72	1.78	2.79	2.33
HCN	ppm	0.26	0.23	0.18	0.19	0.21	0.22
HNCO	ppm	2.83	1.72	1.88	1.66	2.04	1.92
MECHO	ppm	0.80	2.93	3.78	3.66	4.39	2.78
NC5	ppm	0.00	0.00	0.00	0.00	0.00	0.00
NH3	ppm	0.23	0.48	0.18	0.08	0.11	0.21
NO	ppm	460.08	499.60	372.20	310.44	355.13	390.28
NO2	ppm	0.56	0.61	0.50	0.44	2.22	6.45
Soot	mg/m3	21.65	3.03	2.42	1.44	1.34	4.30
AFR	:1	18.29	26.42	33.67	44.28	74.48	32.92



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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	0.009	10.213	81.693	0.944	19.067	0.761
2	0.000	0.003	7.230	80.577	0.931	27.448	0.534
3	0.000	0.003	5.724	79.836	0.923	34.957	0.423
4	0.000	0.004	4.437	78.911	0.912	45.958	0.330
5	0.001	0.003	3.021	76.560	0.885	77.239	0.231

ModeNum	ModalWHC %	ModalC1 %	ModalC8 %	ModalSUM_HC %	ModalT_Emiss %	ModalError %
1	7.047	-2.745	-0.343	-3.088	96.430	3.570
2	1.246	-3.652	-0.457	-4.109	95.473	4.527
3	1.304	-3.510	-0.439	-3.949	95.429	4.571
4	1.403	-3.058	-0.382	-3.441	95.394	4.606
5	0.566	-2.008	-0.251	-2.260	94.275	5.725

Power Run

Team 101

TeamNumber	101
TeamName	North Dakota
Model	Yanmar
Engine	Yanmar

Displacement cc	904.00
RatedSpeed	3642
RatedTorque	80.2

