



Team Results for Clean Snowmobile Challenge 2019 Team 11



2019 Clean Snowmobile Competition - Lab Emission Event Emission Data Sheet

Test Date : 2019/03/08 08:59:09
Team Name : Iowa State
Team Number : 11
Model : R1X
Engine : Yamaha
Displacement[cc] : 1049.00
100% Speed : 8650
100% Torque : 100.1
No of Strokes : 4
Fuel : Gas H/C: 1.95 O/C: 0.00

ModeNum	:	1	2	3	4	5
Weighting	:	0.12	0.27	0.25	0.31	0.05
Power	kW	90.6	39.3	22.4	11.2	0.0
HC_m	g/hr	1303.54	814.41	635.07	89.46	**
CO_m	g/hr	22158.68	5863.59	1797.81	1956.93	**
NOx_m	g/hr	82.34	37.50	12.25	0.72	**
Soot_m	mg/hr	60.67	2.40	1.73	3.15	**
N2O_m	mg/hr	0.78	0.18	0.06	0.06	**
CO2_m	g/hr	41811.43	21691.04	16360.57	11366.53	**
CH4_m	g/hr	58.54	21.04	19.82	12.60	**
W_HC	g/hr	156.42	219.89	158.77	27.73	**
W_CO	g/hr	2659.04	1583.17	449.45	606.65	**
W_NOx	g/hr	9.88	10.13	3.06	0.22	**
W_HCNOx	g/hr	166.31	230.02	161.83	27.95	**
W_Soot	mg/hr	7.28	0.65	0.43	0.98	**
W_N2O	g/hr	0.09	0.05	0.01	0.02	**
W_CO2	g/hr	5017.37	5856.58	4090.14	3523.62	**
W_CH4	g/hr	7.03	5.68	4.95	3.91	**

Total Weighted Power [kW] 30.566

Weighted Emissions

	HC	CO	NOx	HC+NOx
Total Mass [g/hr]	562.81	5298.31	23.29	586.10
Specific Mass [g/kW-hr]	18.41	173.34	0.76	19.17
BSFC [g/kW-hr]	311.2			

Total Soot [mg/hr] 9.34 Specific Soot [mg/kW-hr] 0.31

Not Used for Competition

Total N2O [mg/hr]	0.17	Specific N2O [mg/kW-hr]	0.01
Total CO2 [g/hr]	18487.72	Specific CO2 [g/kW-hr]	604.84
Total CH4 [g/hr]	21.56	Specific CH4 [g/kW-hr]	0.71
RMC BSFC [g/kW-hr]	0		

EMISSION TESTS:

	Value	Limit	Result
Power	90.69	<96.94 kW	PASS
Soot	0.31	<50 mg/kW-hr	PASS
CO	173.34	<275 g/kW-hr	FAIL
HC + NOX	19.17	<90 g/kW-hr	FAIL
E-Score	153.88	>175	FAIL
Valid Data for All 5 Modes			FAIL
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	600	1520	1099	1200	1
PtsInMode	points	1210	3370	3369	1800	1
Speed	rpm	8650.77	7352.03	6484.06	5622.21	0.00
Torque	Nm	100.01	51.08	32.97	19.06	0.00
Power	kW	90.60	39.33	22.38	11.22	0.00
BSFC	g/kw-hr	282.96	270.23	300.55	416.59	**
Fuel	g/hr	25637.04	10628.14	6727.47	4675.37	#####
T_int	degC	20.06	21.79	20.80	22.23	0.00
RelHumid	%	17.29	23.54	20.77	17.67	0.00
Baro	in Hg	28.96	28.97	28.97	28.96	0.00
Baro	mmHg	735.57	735.83	735.81	735.66	0.00
Pvap_kPa	kPa	0.34	0.51	0.43	0.40	0.00
Pvap_inHg	inHg	0.10	0.15	0.13	0.12	0.00
AbsHumidity	grains/lb	15.36	22.99	19.21	17.67	**
SatPres	kPa	97.72	97.59	97.67	97.68	0.00
Hum Factor		0.78	0.80	0.79	0.79	**
F_fac		1.00	1.01	1.00	1.01	**
K_fac		1.02	1.02	1.02	1.02	**
Humidity	g/kg	2.19	3.28	2.74	2.52	**
H2		3.14	1.71	0.72	1.07	**
WetDry Factor		0.87	0.87	0.87	0.87	1.00



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Modal Emissions Concentrations

ModeNum		1	2	3	4	5
THC	ppmC1	7943.00	11719.03	14178.87	2599.76	0.00
CO	%	6.74	4.21	2.00	2.84	0.00
N2O	ppm	15.06	8.20	3.92	5.15	0.00
CH4	ppm	311.60	264.40	386.45	319.77	0.00
CO2	%	8.09	9.91	11.60	10.49	0.00
O2	%	0.03	0.08	0.28	0.82	0.00
CNOx	ppm	152.42	163.93	83.07	6.32	**
AHC	ppm	112.89	121.68	108.27	19.63	0.00
C2H2	ppm	28.45	8.43	6.93	3.98	0.00
C2H4	ppm	140.25	145.68	265.29	95.15	0.00
C3H6	ppm	69.95	108.71	181.98	5.93	0.00
C4H6	ppm	10.17	10.56	6.93	3.14	0.00
ETOH	ppm	5.83	5.88	4.92	4.81	0.00
H2O	%	12.52	13.23	13.28	12.89	0.00
HCHO	ppm	8.37	17.03	27.10	25.26	0.00
HCN	ppm	32.79	26.04	9.91	4.00	0.00
HNCO	ppm	6.44	17.44	16.56	7.25	0.00
MECHO	ppm	2.42	0.39	1.35	0.69	0.00
NC5	ppm	85.54	212.51	202.21	2.59	0.00
NH3	ppm	195.87	367.29	256.42	82.98	0.00
NO	ppm	196.02	205.66	106.30	3.43	0.00
NO2	ppm	0.00	0.00	0.00	4.58	0.00
Soot	mg/m3	0.24	0.02	0.02	0.06	0.00
AFR	:1	10.01	10.26	10.65	13.18	**



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Measurement Accuracy (SAE paper 961804)

ModeNum	H2_XLS %	ModalHC_Dry %	ModalFTIR_H2O %	N2 %	Ar %	AFR :1	Tr_Eff -
1	3.589	0.908	12.521	72.167	0.834	10.950	0.999
2	1.967	1.351	13.233	76.502	0.884	11.771	0.996
3	0.832	1.635	13.276	79.964	0.924	12.617	0.986
4	1.233	0.298	12.889	78.323	0.905	13.624	0.958
5	**	0.000	0.000	0.000	0.000	**	**

ModeNum	ModalWHC %	ModalC1 %	ModalC8 %	ModalSUM_HC %	ModalT_Emiss %	ModalError %
1	1303.539	0.884	0.111	0.995	94.586	5.414
2	814.407	1.281	0.160	1.441	97.182	2.818
3	635.069	1.386	0.173	1.560	99.298	0.702
4	89.460	-0.354	-0.044	-0.398	96.303	3.697
5	**	**	**	**	**	**

Carbon Balance Verification

		1	2	3	4	5
Power	kW	90.602	39.329	22.384	11.223	0.000
BSFC	g/kw-hr	282.96	270.23	300.55	416.59	**
Fuel_MassFlow	g/hr	25637	10628	6727	4675	9999999
HC_m	g/hr	1303.5	814.4	635.1	89.5	**
CO_m	g/hr	22159	5864	1798	1957	**
CO2_m	g/hr	41811	21691	16361	11367	**
TW_Power	kW	30.566				
TW_BSFC	g/kw-hr	311.20				
Fuel_MassFlow	g/hr	25637	10628	6727	4675	9999999
FuelCalc	g/hr	25850	10761	6831	4690	**
FuelCalcDev	%	-0.8292	-1.2512	-1.5421	-0.3108	**

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

Power Run

Team 11

TeamNumber	11
TeamName	Iowa State
Model	R1X
Engine	Yamaha

Displacement cc	1049.00
RatedSpeed	8650
RatedTorque	100.1

