



# Team Results for Clean Snowmobile Challenge 2017 Team 5



## 2017 Clean Snowmobile Competition - Lab Emission Event Emission Data Sheet

Test Date : 2017/03/08 11:50:10  
Team Name : MTU  
Team Number : 5  
Model : Yamaha  
Engine : Yamaha  
Displacement[cc] : 600.00  
100% Speed : 10835  
100% Torque : 43.3  
No of Strokes : 4  
Fuel : Gasoline H/C: 2.38 O/C: 0.24

ModeNum	:	1	2	3	4	5	RMC
Weighting	:	0.12	0.27	0.25	0.31	0.05	1.00
Power kW	:	49.6	19.8	8.9	5.5	0.0	13.8
HC_m g/hr	:	111.10	18.69	36.32	68.73	48.41	21.39
CO_m g/hr	:	2323.56	649.95	1662.56	2174.74	834.65	2247.11
NOx_m g/hr	:	49.29	1.20	0.00	0.02	0.02	2.49
Soot_m mg/hr	:	78.30	1.87	7.82	7.16	1.01	11.71
N2O_m mg/hr	:	0.09	0.02	0.06	0.08	0.02	0.08
CO2_m g/hr	:	53038.08	24839.74	12495.68	9061.79	2587.32	18487.05
CH4_m g/hr	:	40.24	11.37	13.58	19.76	19.36	26.36
W_HC g/hr	:	13.33	5.05	9.08	21.31	2.42	21.39
W_CO g/hr	:	278.83	175.49	415.64	674.17	41.73	2247.11
W_NOx g/hr	:	5.91	0.32	0.00	0.01	0.00	2.49
W_HCNOx g/hr	:	19.25	5.37	9.08	21.31	2.42	23.87
W_Soot mg/hr	:	9.40	0.51	1.95	2.22	0.05	11.71
W_N2O g/hr	:	0.01	0.01	0.01	0.02	0.00	0.08
W_CO2 g/hr	:	6364.57	6706.73	3123.92	2809.15	129.37	18487.05
W_CH4 g/hr	:	4.83	3.07	3.39	6.13	0.97	26.36

Total Weighted Power [kW] 15.236

### Weighted Emissions

	HC	CO	NOx	HC+NOx
Total Mass [g/hr]	51.19	1585.86	6.24	57.43
Specific Mass [g/kW-hr]	3.36	104.08	0.41	3.77
BSFC [g/kW-hr]	534.0			

Total Soot [mg/hr] 14.13 Specific Soot [mg/kW-hr] 0.93

### Not Used for Competition

Total N2O [mg/hr]	0.06	Specific N2O [mg/kW-hr]	0.00
Total CO2 [g/hr]	19133.74	Specific CO2 [g/kW-hr]	1255.81
Total CH4 [g/hr]	18.39	Specific CH4 [g/kW-hr]	1.21
RMC BSFC [g/kW-hr]	522.99		

### EMISSION TESTS:

	Value	Limit	Result
Power	49.12	<96.94 kW	PASS
Soot	0.93	<50 mg/kW-hr	PASS
CO	104.08	<275 g/kW-hr	PASS
HC + NOX	3.77	<90 g/kW-hr	PASS
E-Score	181.47	>175	PASS
Valid Data for All 5 Modes			PASS
RMC			PASS
LAB EMISSION TEST			PASS



# Team Results for Clean Snowmobile Challenge 2017 Team 5



## Modal Raw Data : Engine / Environmental

ModeNum		1	2	3	4	5	RMC
Total Points	points	600	1200	1200	1200	1200	12032
PtsInMode	points	1210	3050	2720	3470	1480	12032
Speed	rpm	10835.30	8566.01	7481.43	7041.94	2223.32	7728.79
Torque	Nm	43.75	22.03	11.42	7.48	0.00	17.08
Power	kW	49.64	19.76	8.95	5.51	0.00	13.83
BSFC	g/kw-hr	376.17	429.53	557.07	753.69	**	522.99
Fuel	g/hr	18672.56	8486.25	4983.06	4154.62	1324.96	7230.59
T_int	degC	21.88	22.66	21.61	22.50	19.50	22.09
RelHumid	%	27.67	26.16	27.24	24.51	29.58	26.53
Baro	in Hg	28.49	28.51	28.51	28.50	28.51	28.50
Baro	mmHg	723.73	724.04	724.19	723.92	724.08	723.98
Pvap_kPa	kPa	0.61	0.60	0.59	0.56	0.57	0.59
Pvap_inHg	inHg	0.18	0.18	0.17	0.16	0.17	0.17
AbsHumidity	grains/lb	27.65	27.24	26.81	25.31	25.93	26.79
SatPres	kPa	95.88	95.93	95.96	95.96	95.96	95.93
Hum Factor		0.82	0.82	0.82	0.81	0.81	0.82
F_fac		1.03	1.03	1.02	1.03	1.02	1.03
K_fac		1.04	1.04	1.04	1.04	1.03	1.04
Humidity	g/kg	3.95	3.89	3.83	3.62	3.70	3.83
H2		0.35	0.21	1.04	1.83	2.42	0.96
WetDry Factor		0.84	0.84	0.84	0.84	0.85	1.00



# Team Results for Clean Snowmobile Challenge 2017 Team 5



## Modal Emissions Concentrations

ModeNum		1	2	3	4	5	RMC
THC	ppmC1	776.73	287.80	985.85	2316.63	5337.78	398.91
CO	%	0.84	0.51	2.32	3.77	4.74	2.16
N2O	ppm	2.12	1.17	4.97	8.87	8.84	4.74
CH4	ppm	253.39	157.72	331.88	599.93	1922.86	442.87
CO2	%	12.14	12.53	11.11	10.00	9.34	11.29
O2	%	0.00	0.00	0.00	0.00	0.28	-0.00
CNOx	ppm	107.93	5.77	0.04	0.19	0.56	14.54
AHC	ppm	10.82	2.58	31.28	99.71	172.32	36.82
C2H2	ppm	5.57	1.09	0.89	1.16	1.04	1.49
C2H4	ppm	82.65	13.85	43.98	106.77	421.02	49.34
C3H6	ppm	8.29	1.44	0.95	14.63	48.63	4.80
C4H6	ppm	6.63	7.12	30.47	16.89	1.55	15.48
ETOH	ppm	10.54	2.39	2.90	1.06	0.46	4.01
H2O	%	16.42	16.27	16.07	15.82	14.60	0.00
HCHO	ppm	5.17	0.35	0.44	0.95	2.02	1.20
HCN	ppm	1.47	0.37	2.28	4.44	0.21	1.59
HNCO	ppm	4.55	3.70	12.97	6.93	0.97	7.05
MECHO	ppm	12.05	0.99	0.00	0.00	0.01	1.96
NC5	ppm	4.11	3.50	15.99	56.37	59.12	16.93
NH3	ppm	117.49	167.93	1058.52	457.97	50.44	475.71
NO	ppm	132.13	7.78	0.32	0.22	0.48	19.14
NO2	ppm	0.77	0.41	0.05	0.21	0.50	0.28
Soot	mg/m3	0.32	0.02	0.13	0.15	0.07	0.13
AFR	:1	10.65	10.90	10.04	9.22	8.46	10.25



# Team Results for Clean Snowmobile Challenge 2017 Team 5



Measurement Accuracy (SAE paper 961804)

ModeNum	H2_XLS %	ModalHC_Dry %	ModalFTIR_H2O %	N2 %	Ar %	AFR :1	Tr_Eff -
1	0.414	0.093	16.422	86.476	1.000	14.767	1.000
2	0.251	0.034	16.269	87.055	1.006	14.980	1.000
3	1.240	0.117	16.074	84.268	0.974	14.016	1.000
4	2.174	0.275	15.824	81.960	0.947	13.182	1.000
5	2.835	0.625	14.599	79.383	0.918	12.649	0.986

ModeNum	ModalWHC %	ModalC1 %	ModalC8 %	ModalSUM_HC %	ModalT_Emiss %	ModalError %
1	111.103	0.092	0.012	0.104	103.536	3.536
2	18.687	0.034	0.004	0.039	103.925	3.925
3	36.320	0.117	0.015	0.132	102.613	2.613
4	68.733	0.275	0.034	0.310	101.751	1.751
5	48.406	0.378	0.047	0.425	100.373	0.373

# Power Run

Team 5

TeamNumber	5
TeamName	MTU
Model	Yamaha
Engine	Yamaha

Displacement cc	600.00
RatedSpeed	10835
RatedTorque	43.3

