

**HNO Green Fuels**  
**Cummins ISM 400-1800 Serial Nr.: 60412072**  
**Olson-Ecologic Engine Testing Laboratories**  
**Supplemental Emission Test (SET) Test Nr.: HNOHYDSET032213\_04**  
**Baseline**

Mode	EngSpd RPM	DynTrq lb-ft	EngPwr Hp	Dilute WCO2 %	Dilute WCO ppm	Dilute WNOx ppm	Dilute WNO ppm	Dilute WHC ppmC	FUEL RT GM/MIN	AirMas scfm	EngExh deg/F	ABSHUM grain/lb	Air In degF	Baro P InHga	Ex. P In.H2O	Dilute KNOx ppm	FuelIn degF	Dilute KNO ppm	Fuel psig	Dilute WMethane ppm	Dilute WNMHC ppm	ABSHUM g/kg	Sat Vapor Press mmHg	Oil P psig	Humidy %
1	705.0	-1.1	-0.1	0.04	4.3	6.7	6.7	3.4	20.3	99.8	199.0	52.32	76.8	29.62	-2.0	6.2	87.9	6.2	0.0	3.4	7.474	23.57	21.4	38.0	
2	1280.0	1200.2	295.8	1.74	16.4	154.4	153.4	9.4	725.5	465.9	728.2	51.86	76.6	29.63	11.9	145.6	88.5	144.6	0.0	9.4	7.409	23.45	28.5	37.8	
3	1508.6	628.6	182.0	1.24	12.5	105.5	103.7	7.7	454.8	380.6	756.4	51.42	76.9	29.62	9.0	99.3	89.7	97.6	0.0	7.7	7.346	23.67	27.6	37.2	
4	1518.4	948.6	274.2	1.61	10.0	229.8	226.2	9.2	638.5	474.9	765.7	50.72	77.4	29.62	13.9	216.0	91.2	212.7	0.0	9.2	7.246	24.04	27.0	36.1	
5	1299.0	636.9	157.6	1.01	8.7	135.7	133.1	8.2	382.0	293.0	785.4	49.90	77.8	29.62	4.1	127.3	93.9	124.9	0.0	8.2	7.129	24.36	24.5	35.1	
6	1296.1	957.4	236.2	1.37	10.3	185.9	183.3	8.9	556.3	370.5	831.3	49.50	78.1	29.63	8.5	174.2	95.8	171.8	0.0	8.9	7.072	24.64	24.6	34.4	
7	1294.3	317.1	78.7	0.58	8.3	76.0	73.8	7.4	204.0	227.0	687.8	49.07	78.4	29.63	0.9	71.1	97.1	69.0	0.0	7.4	7.010	24.91	24.2	33.7	
8	1512.1	1148.4	331.6	1.91	11.8	237.1	232.3	11.2	779.5	557.0	770.1	49.12	78.6	29.64	18.1	222.1	98.5	217.5	0.0	11.2	7.017	25.07	25.9	33.5	
9	1517.1	318.2	92.0	0.72	10.1	87.6	84.2	9.2	247.8	275.0	681.9	48.85	78.9	29.64	3.5	81.9	100.3	78.7	0.0	9.2	6.979	25.30	24.6	33.1	
10	1736.7	1099.5	364.1	2.12	13.3	255.9	249.5	13.2	869.8	665.6	747.0	48.79	79.0	29.65	26.8	239.5	101.7	233.5	0.0	13.2	6.970	25.42	25.3	32.9	
11	1739.3	266.5	88.5	0.76	12.1	86.0	81.7	11.2	255.5	322.9	644.5	48.38	79.3	29.65	4.4	80.4	103.5	76.3	0.0	11.2	6.911	25.62	25.8	32.3	
12	1742.3	821.0	271.9	1.53	11.0	204.9	199.5	11.8	649.3	536.5	705.6	48.21	79.3	29.66	16.1	191.5	105.6	186.4	0.0	11.8	6.887	25.63	24.8	32.2	
13	1739.5	544.1	180.6	1.14	10.1	146.3	141.5	11.3	452.3	426.9	694.7	48.04	79.5	29.66	9.7	136.3	107.6	132.1	0.0	11.3	6.863	25.80		31.9	

----- GRAMS/HOUR -----											Raw Exhaust Flow (scmm)	Raw Exhaust Flow (g/h)	Sample Time GP (slpm) (sl)				V <sub>sf</sub> Ft. <sup>3</sup>	VMIX Ft. <sup>3</sup>
Mode	WT. FAC	HC	CO	KNOX	KNO	FUEL	EXHAUST	CO2	NMHC			Mode	Time (Sec.)	GP (g/s)	(slpm)	(sl)		
0.15	1	16.48	42.02	99.80	99.69	1215	279450	5593	16.48	3.87	300321	PARTIC. WT, MG = 0.41	90	0.088	4.3780	6.5670	0.2319114	3712.8
0.08	2	22.55	80.15	1168.02	1159.89	43530	1417437	133600	22.56	19.60	1523303		48	0.454	22.5865	18.0692	0.6381078	1974.8
0.10	3	18.55	61.27	797.21	783.70	27285	1122078	95114	18.56	15.52	1205885		60	0.361	17.9598	17.9598	0.6342426	2469.6
0.10	4	22.15	48.98	1732.88	1705.99	38310	1390004	123634	22.16	19.23	1493821		60	0.453	22.5368	22.5368	0.7958776	2467.9
0.05	5	19.69	42.37	1022.26	1002.93	22920	794076	77576	19.70	10.98	853384		30	0.278	13.8305	6.9153	0.2442097	1235.6
0.05	6	21.44	50.42	1398.52	1379.15	33375	1078194	105433	21.44	14.91	1158723		30	0.359	17.8603	8.9301	0.3153644	1234.9
0.05	7	17.88	40.70	571.36	554.89	12240	540835	44646	17.89	7.48	581230		30	0.211	10.4973	5.2486	0.1853534	1236.5
0.09	8	27.04	57.45	1780.52	1744.18	46770	1609382	146584	27.05	22.26	1729585		54	0.536	26.6660	23.9994	0.8475308	2220.2
0.10	9	22.23	49.64	659.22	633.24	14865	648310	55775	22.23	8.97	696732		60	0.256	12.7360	12.7360	0.4497676	2476.1
0.08	10	31.85	64.74	1920.68	1872.89	52185	1897416	162771	31.86	26.24	2039132		48	0.619	30.7953	24.6362	0.8700192	1974.0
0.05	11	27.07	59.51	647.42	614.85	15330	750735	58417	27.08	10.38	806807		30	0.296	14.7260	7.3630	0.2600219	1239.1
0.05	12	28.53	53.65	1537.87	1497.56	38955	1469344	117201	28.54	20.32	1579088		30	0.506	25.1735	12.5868	0.4444969	1235.7
0.05	13	27.26	49.49	1098.22	1062.17	27135	1096555	87432	27.27	15.17	1178455		30	0.389	19.3528	9.6764	0.341718	1236.7

<b>WTD AVG BHP = 188.13</b>	<b>KW = 140.29</b>									600 Sec.	P <sub>mass</sub> g
	HC	CO	KNOX	KNO	FUEL	EXHAUST	CO2	NMHC	Raw Exhaust	0.17 Hr.	6.258622 24713.94 1.6194114
<b>WTD AVG GM/H = 22.65</b>	<b>53.86</b>	<b>1055.02</b>	<b>1032</b>	<b>27593</b>	<b>1054476</b>	<b>89729</b>	<b>22.65</b>		1133234		<b>P<sub>wm</sub> = 0.0516 g/bhp-hr</b>
<b>WTD GM/BHPH = 0.12</b>	<b>0.29</b>	<b>5.61</b>	<b>5.49</b>	<b>146.67</b>		<b>476.95</b>	<b>0.12</b>				<b>P<sub>wm</sub> = 0.0693 g/kw-hr</b>
<b>WTD GM/KWH = 0.16</b>	<b>0.38</b>	<b>7.52</b>	<b>7.36</b>	<b>196.68</b>		<b>639.59</b>	<b>0.16</b>				

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**Cummins ISM 400-1800 Serial Nr.: 60412072**  
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**Supplemental Emission Test (SET) Test Nr.: HNOSETHYD040513\_01**

Mode	EngSpd RPM	DynTrq lb-ft	EngPwr Hp	Dilute WCO2 %	Dilute WCO ppm	Dilute WNOx ppm	Dilute WNO ppm	Dilute WHC ppmC	FUEL RT GM/MIN	AirMas scfm	EngExh deg/F	ABSHUM grain/lb	Air In degF	Baro P InHga	Exh. P In.H2O	Dilute KNOx ppm	FuelIn degF	Dilute KNO ppm	Dilute WMethane ppm	Dilute WNMHC ppm	ABSHUM g/kg	Sat Vapor Press mmHg	Oil P psig	Humidy %	CoolOt degF
1	706.4	-0.7	-0.1	0.05	3.3	6.0	5.3	3.8	17.8	97.1	216.3	60.87	80.4	29.81	-2.5	5.7	99.4	5.0	0.1	3.7	8.696	26.57	16.5	39.3	176.8
2	1280.6	1201.0	296.1	1.76	16.7	153.8	150.8	9.8	724.8	462.9	744.3	60.00	80.0	29.84	11.4	148.0	101.9	145.0	0.0	9.8	8.571	26.27	26.1	39.3	179.8
3	1509.4	629.0	182.2	1.25	12.7	104.8	101.0	7.8	454.0	381.5	767.3	59.16	80.0	29.83	8.4	100.6	103.7	96.9	0.0	7.8	8.452	26.24	26.0	38.8	178.7
4	1518.9	948.0	273.8	1.63	8.8	225.7	220.0	9.3	643.0	479.4	776.2	58.68	80.3	29.83	13.4	216.5	105.7	210.9	0.0	9.3	8.383	26.51	25.6	38.1	179.3
5	1299.3	636.9	157.6	1.03	10.3	133.4	129.4	8.0	383.0	295.9	796.9	58.06	80.7	29.83	3.6	127.7	107.7	123.8	0.0	8.0	8.294	26.87	23.5	37.2	179.3
6	1295.6	956.6	235.9	1.40	10.6	181.6	177.9	8.7	557.3	370.4	842.2	57.64	81.0	29.84	8.0	173.7	108.7	170.1	0.0	8.7	8.234	27.11	22.5	36.6	180.2
7	1294.6	317.5	78.7	0.61	8.1	74.8	71.3	7.1	204.0	228.1	695.2	57.08	81.3	29.84	0.5	71.4	109.4	68.0	0.1	7.0	8.154	27.37	22.7	35.9	177.6
8	1512.1	1148.4	331.6	1.96	12.0	228.9	222.5	11.0	781.5	563.9	778.0	57.32	81.5	29.85	17.8	218.8	110.6	212.6	0.0	11.0	8.189	27.56	24.2	35.8	179.7
9	1517.2	318.2	92.0	0.75	9.9	85.7	80.9	8.8	245.5	275.8	688.6	56.82	81.8	29.85	3.0	81.8	111.9	77.1	0.1	8.7	8.117	27.81	23.4	35.2	177.6
10	1736.6	1090.5	361.2	2.15	13.3	247.4	239.3	12.9	864.5	661.5	754.9	57.14	82.0	29.85	26.2	236.3	113.4	228.6	0.0	12.9	8.164	27.99	23.7	35.1	179.6
11	1739.4	266.4	88.6	0.78	11.5	83.3	77.6	10.8	255.0	324.1	650.9	56.41	82.2	29.85	4.0	79.4	115.8	73.9	0.1	10.7	8.058	28.18	24.0	34.5	177.4
12	1742.3	821.3	272.0	1.56	11.0	201.5	194.6	11.5	649.8	534.8	714.5	56.18	82.1	29.86	15.8	192.1	118.4	185.4	0.0	11.5	8.026	28.13	23.2	34.4	179.2
13	1739.7	543.9	180.6	1.16	10.1	141.0	134.7	10.9	453.5	428.1	698.4	56.03	82.3	29.86	9.4	134.3	120.7	128.2	0.1	10.8	8.004	28.23	23.2	34.2	178.8

----- GRAMS/HOUR -----										Raw Exhaust Flow (scmm)	Raw Exhaust Flow (g/h)	Sample Time GP (slpm)					V <sub>sf</sub> (Ft. <sup>3</sup> )	VMIX (Ft. <sup>3</sup> )			
Mode	WT. FAC	No	HC	CO	KNOX	KNO	FUEL	EXHAUST	CO2	NMHC	Mode	Time (Sec.)	GP (g/s)	(slpm)	(sl)	V <sub>sf</sub> (Ft. <sup>3</sup> )	VMIX (Ft. <sup>3</sup> )				
0.15	1	18.16	31.93	92.02	80.17	1065	275450	7466	17.87	3.81	296023	PARTIC. WT, MG =	0.23	0.00023	1	90	0.088	4.3780	6.5670	0.23191	3707.1
0.08	2	23.64	81.67	1188.37	1164.82	43485	1429622	135570	23.64	19.77	1536399		2	48	0.453	22.5368	18.0294	0.6367	1977.0		
0.10	3	18.78	62.10	807.30	777.93	27240	1120635	95924	18.78	15.50	1204334		3	60	0.361	17.9598	17.9598	0.63424	2469.9		
0.10	4	22.39	50.19	1736.67	1691.70	38580	1390697	124860	22.40	19.24	1494567		4	60	0.453	22.5368	22.5368	0.79588	2468.0		
0.05	5	19.19	42.95	1025.27	994.36	22980	800774	79091	19.20	11.08	860583		5	30	0.278	13.8305	6.9153	0.24421	1235.3		
0.05	6	20.87	51.64	1394.20	1365.45	33435	1082898	107841	20.88	14.98	1163778		6	30	0.359	17.8603	8.9301	0.31536	1234.9		
0.05	7	17.13	39.57	573.66	546.65	12240	550712	46802	16.86	7.62	591843		7	30	0.211	10.4973	5.2486	0.18535	1236.3		
0.09	8	26.40	58.75	1754.56	1704.79	46890	1633057	150720	26.40	22.59	1755028		8	54	0.536	26.6660	23.9994	0.84753	2220.9		
0.10	9	21.35	48.34	658.60	620.50	14730	659440	58033	21.06	9.12	708693		9	60	0.256	12.7360	12.7360	0.44977	2476.3		
0.08	10	30.98	64.84	1896.13	1833.76	51870	1903047	165005	30.99	26.32	2045183		10	48	0.619	30.7953	24.6362	0.87002	1974.7		
0.05	11	26.11	56.48	639.47	595.38	15300	761041	60151	25.79	10.53	817882		11	30	0.296	14.7260	7.3630	0.26002	1239.0		
0.05	12	27.74	53.51	1541.92	1488.63	38985	1484791	119698	27.74	20.54	1595689		12	30	0.506	25.1735	12.5868	0.4445	1235.0		
0.05	13	26.27	49.45	1080.87	1031.81	27210	1115344	89073	26.15	15.43	1198648		13	30	0.389	19.3528	9.6764	0.34172	1237.7		

<b>WTD AVG BHP = 187.89</b>	<b>KW = 140.11</b>									600 Sec.	P <sub>mass</sub> g
	HC	CO	KNOX	KNO	FUEL	EXHAUST	CO2	NMHC	Raw Exhaust	0.17 Hr.	6.257216 24712.22 0.90859
<b>WTD AVG GM/H = 22.59</b>	<b>52.54</b>	<b>1051.50</b>	<b>1015</b>	<b>27571</b>	<b>1061761</b>	<b>91745</b>	<b>22.48</b>	1141063			<b>P<sub>wm</sub> = 0.0290 g/bhp-hr</b>
<b>WTD GM/BHPH = 0.12</b>	<b>0.28</b>	<b>5.60</b>	<b>5.40</b>	<b>146.74</b>	<b>488.28</b>	<b>0.12</b>					<b>P<sub>wm</sub> = 0.0389 g/kw-hr</b>
<b>WTD GM/KWH = 0.16</b>	<b>0.37</b>	<b>7.50</b>	<b>7.25</b>	<b>196.78</b>	<b>654.80</b>	<b>0.16</b>					