



FINAL REPORT

**Of The Dynamic Fuel Systems, Inc. on a Detroit Diesel Series 60
Diesel Heavy Duty Engine**

Testing Conducted By

**California Environmental Engineering, LLC
2530 S. Birch Street
Santa Ana, Ca. 92707**

**CEE is an Independent Emission Testing Facility
Listed on the Recognized Laboratories List
By EPA and CARB**



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TEST ENGINE

Engine

Year	: 2002
Make	: Detroit Diesel
Model	: Series 60
Eng. Family	: 2DDXH12.7EGL



TEST LABORATORY

California Environmental Engineering is an EPA and CARB recognized Emission Testing Facility located in Santa Ana, Ca.. CEE has been in business since 1984. CEE conducts Chassis and Engine Dynamometer Emission testing on vehicles up to 12,000# and Engines up to 1000 HP.

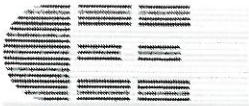
CEE also provides procurement and engineering services. CEE is a current contractor to the CARB. CEE has many product development companies and major manufacturers as clients.

TEST EQUIPMENT

CEE uses a Horiba Analytical train for emission analyzation, a CEE 4000 variable volume CVS and a A&D 1000 HP Dynamometer with A and D controls. An AVL Particulate Sampler.



TEST DATA



CALIFORNIA ENVIRONMENTAL ENGINEERING

2530 S. Birch Street
Santa Ana CA 92707
714 545 9822

rppVersion_Wght 1.0

1.1 Cold Start Test

Test Date	01-28-2012	Cell Number	D1000
Test Time	10:46:00 AM	Air Temperature	80.4 °F
Test Name	Test3HDDT	Atmospheric Pressure	771.9 mm.Hg
Test Engineer	Fernando Fermin	Relative Humidity	4.8 %
Test Reference	Test3HDDT_293	Fuel Type	Diesel 2

1.2 Hot Start Test

Test Date	01-28-2012	Cell Number	D1000
Test Time	10:46:00 AM	Air Temperature	83.4 °F
Test Name	Test3HDDT	Atmospheric Pressure	772.3 mm.Hg
Test Engineer	Fernando Fermin	Relative Humidity	3.4 %
Test Reference	Test3HDDT_294	Fuel Type	Diesel 2

2. Engine Specification

Engine Description	ETROIT 60 SERIES	Max. Power	430 bhp @	2100 RPM
Engine ID	2DDXH12.7EGL	Max. Torque	1450 lb-ft @	1200 RPM
Engine Displacement	13000 cc	Max. Speed		2100 RPM
Cyls x Bore x Stroke	0x 0 mm x168 mm	Idle Speed		600 RPM

4.1 Cold Start Test Results Grams Brake Horespower Hour.

Work [bhp-hr]	CO [g/hp-hr]	THC [g/hp-hr]	NOx [g/hp-hr]	CO2 [g/hp-hr]	NMHC [g/hp-hr]	BSFC [lb/hp-hr]	PM [g/hp-hr]
29.1	2.489	0.105	3.161	710.0	0.099	0.495	0.0685

4.2 Hot Start Test Results Grams Brake Horespower Hour.

Work [bhp-hr]	CO [g/hp-hr]	THC [g/hp-hr]	NOx [g/hp-hr]	CO2 [g/hp-hr]	NMHC [g/hp-hr]	BSFC [lb/hp-hr]	PM [g/hp-hr]
28.3	1.617	0.076	3.108	691.0	0.003	0.481	0.0403

4.3 Weighted Cold and Hot Test Results Grams Brake Horespower Hour.

Work hp	CO g/hp-hr	THC g/hp-hr	NOx g/hp-hr	CO2 g/hp-hr	NMHC g/hp-hr	BSFC lb/hp-hr	PM g/hp-hr
28.4	1.745	0.080	3.116	693.8	0.017	0.483	0.0444

4.4 Cold Start Test Results Grams Per Kilowatt Hour.

Work [kw-hr]	CO [g/kw-hr]	THC [g/kw-hr]	NOx [g/kw-hr]	CO2 [g/kw-hr]	NMHC [g/kw-hr]	BSFC [kg/kw-hr]	PM [g/kw-hr]
21.7	3.337	0.140	4.239	952.2	0.133	0.224	0.0919

4.5 Hot Start Test Results Grams Per Kilowatt Hour.

Work [kw-hr]	CO [g/kw-hr]	THC [g/kw-hr]	NOx [g/kw-hr]	CO2 [g/kw-hr]	NMHC [g/kw-hr]	BSFC [kg/kw-hr]	PM [g/kw-hr]
21.1	2.168	0.102	4.167	926.6	0.005	0.218	0.0540

4.6 Weighted Cold and Hot Test Results Grams Per Kilowatt Hour.

Work [kw-hr]	CO [g/kw-hr]	THC [g/kw-hr]	NOx [g/kw-hr]	CO2 [g/kw-hr]	NMHC [g/kw-hr]	BSFC [kg/kw-hr]	PM [g/kw-hr]
21.2	2.340	0.107	4.178	930.4	0.023	0.219	0.0596

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Date 2/6/12 By: P. Duranishi



1. Test

Test Date	01-28-2012	Cell Number	D1000
Test Time	10:46:00 AM	Air Temperature	80.4 °F
Test Name	Test3HDDT	Atmospheric Pressure	771.9 mm.Hg
Test Engineer	Fernando Fermin	Relative Humidity	4.8 %
Test Reference	Test3HDDT_293	Fuel Type	Diesel 2

2. Engine Specification

Engine Description	ETROIT 60 SERIES	Max. Power	430 bhp @ 2100 RPM
Engine ID	2DDXH12.7EGL	Max. Torque	1450 lb-ft @ 1200 RPM
Engine Displacement	13000 cc	Max. Speed	2100 RPM
Cyls x Bore x Stroke	6x 133 mm x168 mm	Idle Speed	600 RPM

3. Cycle Specification

Cycle Type	Cold US.HDDT.nrm	Test Speed Idle	600 RPM
Power Map Name	Test2PowerMap_281Trans.dat	Test Speed Rated	2100 RPM
Cycle File	HDDTMap281Denorm1.sc2		

4. Test Results

	Work [hr]	CO [g/-hr]	THC [g/-hr]	NOx [g/-hr]	CO2 [g/-hr]	NMHC [g/-hr]	BSFC [l/-hr]	PM [g/-hr]
hp	29.1 hp	2.489 hp	0.105 hp	3.161 hp	710.0 hp	0.099 lb	0.495 hp	0.0685
kw	21.7 kw	3.337 kw	0.140 kw	4.239 kw	952.2 kw	0.133 kg	0.224 kw	0.0919

5. Sample

	CO [ppm]	THC [ppm]	NOx [ppm]	CO2 [%]	CH4 [ppm]	Concentrations	
Exhaust	46.093	6.626	40.690	0.840	2.725		
Ambient	1.588	3.091	0.917	0.048	2.692		

6. Corrected Concentrations and Mass

	CO [ppm]	THC [ppm]	NOx [ppm]	CO2 [%]	CH4 [ppm]	NMHC [ppm]
Conc.	0.000	3.730	39.831	0.795	0.203	3.527
Mass [g]	72.502	3.047	92.089	20684.5	N/A	2.882

7. Other

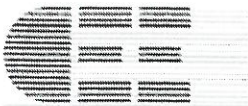
Total Volume (Vmix)	50217 SCF	Absolute Humidity	7.17 gr/lb
Dilution Volume	42970 SCF	NOx Correction Factor	0.850
Exhaust Volume	7248 SCF	Dry to Wet CF	0.991
Dilution (Total/Exhaust)	6.929	Dilution Factor (DF)	15.85
Particulate Mass	2.513 mg	Stoichiometric Factor	13.4
		denHC	16.27 g/ft^3

8. Hot Analyzer Results

Sample Concentrations		Corrected Concentrations and Mass		Brake Specific	
No ppm	HHC ppm	No ppm	HHC ppm	No ppm	HHC [g/-hr]
0.000	0.000	0.000	0.000	hp	0.000 hp
		0.000	0.000	kw	0.000 kw

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 Date 2/6/12 By: [Signature]



CALIFORNIA ENVIRONMENTAL ENGINEERING

2530 S. Birch Street
Santa Ana CA 92707
714 545 9822

Report Version: 2.0

1. Test

Test Date	01-28-2012	Cell Number	D1000
Test Time	10:46:00 AM	Air Temperature	83.4 °F
Test Name	Test3HDDT	Atmospheric Pressure	772.3 mm.Hg
Test Engineer	Fernando Fermin	Relative Humidity	3.4 %
Test Reference	Test3HDDT_294	Fuel Type	Diesel 2

2. Engine Specification

Engine Description	ETROIT 60 SERIES	Max. Power	430 bhp @ 2100 RPM
Engine ID	2DDXH12.7EGL	Max. Torque	1450 lb-ft @ 1200 RPM
Engine Displacement	13000 cc	Max. Speed	2100 RPM
Cyls x Bore x Stroke	6x 133 mm x168 mm	Idle Speed	600 RPM

3. Cycle Specification

Cycle Type	Hot US.HDDT.nrm	Test Speed Idle	600 RPM
Power Map Name	Test2PowerMap_281Trans.dat	Test Speed Rated	2100 RPM
Cycle File	HDDTMap281Denorm1.sc2		

4. Test Results

Work [hr]	CO [g/-hr]	THC [g/-hr]	NOx [g/-hr]	CO2 [g/-hr]	NMHC [g/-hr]	BSFC [l/-hr]	PM [g/-hr]
hp 28.3 hp	1.617 hp	0.076 hp	3.108 hp	691.0 hp	0.003 lb	0.481 hp	0.0403
kw 21.1 kw	2.168 kw	0.102 kw	4.167 kw	926.6 kw	0.005 kg	0.218 kw	0.0540

5. Sample Concentrations

	CO [ppm]	THC [ppm]	NOx [ppm]	CO2 [%]	CH4 [ppm]
Exhaust	29.709	5.484	38.999	0.797	2.502
Ambient	1.712	3.043	0.916	0.049	0.000

6. Corrected Concentrations and Mass

	CO [ppm]	THC [ppm]	NOx [ppm]	CO2 [%]	CH4 [ppm]	NMHC [ppm]
Conc.	0.000	2.623	38.138	0.751	2.502	0.121
Mass [g]	45.730	2.143	87.891	19542.6	N/A	0.099

7. Other

Total Volume (Vmix)	50231 SCF	Absolute Humidity	5.59 gr/lb
Dilution Volume	43070 SCF	NOx Correction Factor	0.847
Exhaust Volume	7162 SCF	Dry to Wet CF	0.992
Dilution (Total/Exhaust)	7.013	Dilution Factor (DF)	16.74
Particulate Mass	1.438 mg	Stoichiometric Factor	13.4
		denHC	16.27 g/ft^3

8. Hot Analyzer Results

Sample Concentrations		Corrected Concentrations and Mass		Brake Specific	
No ppm	HHC ppm	No ppm	HHC ppm	No ppm	HHC [g/-hr]
0.000	0.000	0.000	0.000	hp 0.000 hp	0.000
		0.000	0.000	kw 0.000 kw	0.000

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ESC TEST REPORT

1. Test

Test Date	01-28-2012	Cell Number	D1000
Test Time	12:19:18 PM	Air Temperature	89.99 F
Test Name	Esc	Atmospheric Pressure	772.3 mmHg
Test Engineer	Fernando Fermin	Relative Humidity	2.5 %
Test Reference	Esc_295	Fuel Type	Diesel

2. Engine Specification

Engine Description	DETROIT 60 SERIES	Max Power	430.0 hp	2100 rpm
Engine ID	2DDXH12.7EGL	Max Troque	1450.0 lb-ft	1200 rpm
Engine Owner	DYNAMIC FUEL SYSTEMS	Max Speed		2100 rpm
Engine Displacement	13000 cc	Idle Speed		600 rpm

Cysl x Bore x Stroke

3. Cycle Specification

Idle Speed	600 rpm	A Speed	1188 rpm	A Torque	1473 ft-lb
Low Speed	1049 rpm	B Speed	1327 rpm	B Torque	1523 ft-lb
High Speed	1606 rpm	C Speed	1467 rpm	C Torque	1467 ft-lb

4. Steady-State Test Results

Mode	Speed rpm	Torque lb-ft	Weight Factor	Power hp	Fuel kg/h	CO g/h	THC g/h	CH4 g/h	NOx g/h	CO2 g/h	HHC g/h	HNOX g/h
1	613	0.1	0.15	0.012	3.256	19.8	10.34	7.785	96.71	10261	0	0
2	1188	1484	0.08	335.3	56.72	453.6	13.51	6.531	2025	179075	0	0
3	1327	761.5	0.1	192.3	35.6	146.5	12.9	7.068	774.3	112615	0	0
4	1327	999.9	0.1	252.4	44.79	155.3	12.62	6.942	1151	141721	0	0
5	1188	736.8	0.05	166.5	31.27	201.3	12.48	7.274	712	98792	0	0
6	1188	1000	0.05	226.0	39.87	208.3	12.35	7.241	1046	126039	0	0
7	1188	368	0.05	83.2	17.02	61.68	14.4	7.661	416.2	53823	0	0
8	1327	1512	0.09	381.8	64.87	233.8	14.59	6.599	2493	205262	0	0
9	1327	380.6	0.1	96.1	20.07	87.22	16.24	7.621	432.8	63443	0	0
10	1467	1488	0.08	415.3	70.68	188.2	14.8	6.346	2766	223776	0	0
11	1467	376.1	0.05	105.0	21.9	99.59	17.67	7.698	393.8	69228	0	0
12	1467	1000	0.05	279.2	51.87	113.5	14.18	7.223	1138	164250	0	0
13	1467	751.9	0.05	209.9	40.35	118.8	14.54	7.69	738.4	127690	0	0

	hp	g/hphr	g/hphr	g/hphr	g/hphr	g/hphr	g/hphr	g/hphr	g/hphr
Weighted Totals	202.0	181.6	0.765	0.067	0.036	5.348	574.35	0	0

Particulate Mass 0.775 mg Brake Specific Particulates 0.578 g/hphr

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NTE TEST REPORT

1. Test

Test Date	01-28-2012	Cell Number	D1000
Test Time	12:19:18 PM	Air Temperature	89.992 F
Test Name	Esc	Atmospheric Pressure	772.33 mmHg
Test Engineer	Fernando Fermin	Relative Humidity	2.5 %
Test Reference	Esc_295	Fuel Type	Diesel

2. Engine Specification

Engine Description	DETROIT 60 SERIES	Max Power	430.0 hp	2100 rpm
Engine ID	2DDXH12.7EGL	Max Troque	1450.0 lb-ft	1200 rpm
Engine Owner	DYNAMIC FUEL SYSTEMS	Max Speed		2100 rpm
Engine Displacement	13000 cc	Idle Speed		600 rpm
Cysl x Bore x Stroke				

3. Cycle Specification

Idle Speed	600 rpm	A Speed	1188 rpm	A Torque	1473 ft-lb
Low Speed	1049 rpm	B Speed	1327 rpm	B Torque	1523 ft-lb
High Speed	1606 rpm	C Speed	1467 rpm	C Torque	1467 ft-lb

4. Steady-State Test Results

Mode	Speed rpm	Torque lb-ft	Weight Factor	Power hp	Fuel kg/h	CO g/h	THC g/h	CH4 g/h	NOx g/h	NOx g/hphr	CO2 g/h	HHC g/h	HNOX g/h
2	1188	1484	0.08	335.6	56.72	453.6	13.51	6.531	2025	6.034	179075	0	0
3	1327	761.5	0.1	192.4	35.6	146.5	12.9	7.068	774.3	2.307	112615	0	0
4	1327	999.9	0.1	252.6	44.79	155.3	12.62	6.942	1151	3.431	141721	0	0
5	1188	736.8	0.05	166.7	31.27	201.3	12.48	7.274	712	2.122	98792	0	0
6	1188	1000	0.05	226.2	39.87	208.3	12.35	7.241	1046	3.116	126039	0	0
8	1327	1512	0.09	382.1	64.87	233.8	14.59	6.599	2493	6.524	205262	0	0
10	1467	1488	0.08	415.6	70.68	188.2	14.8	6.346	2766	6.655	223776	0	0
12	1467	1000	0.05	279.4	51.87	113.5	14.18	7.223	1138	3.392	164250	0	0
13	1467	751.9	0.05	210	40.35	118.8	14.54	7.69	738.4	2.2	127690	0	0

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 Date 2/6/12 By: J. Blumrich



TEST SUMMARY

Detroit Diesel Series 60

Dynamic Fuel Product Results	<u>NMHC</u>	<u>CO</u>	<u>NOX</u>	<u>PM</u>	<u>BSFC</u>
HDDT	0.017	1.745	3.116	0.0444	0.483
ESC	0.036	0.765	5.348	0.0578	
NTE			6.655		

Standards

FTP EMISSIONS	HC-1.3	NOX-4.0	CO-15.5	PM-0.10
EURO III	HC-1.3	NOX-6.0	CO-15.5	PM-0.10
NTE		NOX-7.0		