



AUTOMOTIVE TESTING AND DEVELOPMENT SERVICES, INC.

Thursday, June 8, 2000

Reference: Chevrolet Impala with the Fitch Fuel Catalyst

Mr. Chris Wright
Advanced Power Systems International
558 Lime Rock Road
Lakeville, CT 06039

Dear Mr. Wright:

Automotive Testing and Development Services, Inc. (ATDS) is pleased to provide this report covering testing conducted on the Fitch Fuel Catalyst installed in a Chevrolet Impala. This testing was conducted in strict accordance with 40 CFR 86 and California Title 13. ATDS' QA representative has subjected all tests to a rigorous quality audit.

A brief report of testing conducted follows:

Project Overview

This testing was conducted on behalf of Advanced Power Systems International in conjunction with their application to the California Air Resources Board (CARB) for an Executive Order exempting the Fitch Fuel Catalyst from the prohibitions of the California Vehicle Code, Section 27156. The project work scope consisted of the following activities: Conduct (3) FTP emissions tests and a 1000 mile Mileage Accumulation on a Chevrolet Impala. Work commenced on 5/1/2000 and was completed on 6/2/2000. There were no unusual conditions noted on the vehicle during testing.

Vehicle Information

The following vehicle was tested in this project:

ATDS Vehicle ID: 777-2
VIN: 1L69L9C130404
Vehicle Make: Chevrolet
Vehicle Model: IMPALA

Model Year: 1999



Engine Family: 5.7 Liter

Odometer: 17616

Test Device Information

The following device was installed on the above vehicle:

Fitch Inline Fuel Catalyst

Device Maker: Advanced Power Systems International

Device Model: F6T

Device Serial No.: N/A

Test Sequence and Chronology

The following test sequence and chronology were used in this program.

- **4/30/2000** Chevrolet Impala received into ATDS laboratory.
- **4/30/2000** Vehicle preconditioned for FTP.
- **5/1/2000** Performed Baseline FTP.
- **5/4/2000** Installed Fitch Fuel Catalyst
- **5/5/2000** Started 500 mile Mileage Accumulation
- **5/6/2000** Completed 500 mile Mileage Accumulation
- **5/7/2000** Preconditioned for FTP.
- **5/8/2000** Performed FTP
- **5/30/2000** Resumed Mileage Accumulation.
- **6/1/2000** Completed 1000 mile Mileage Accumulation.
- **6/1/2000** Vehicle preconditioned for FTP.



- 6/2/2000 Performed FTP.

Test Results

Test #1

Test Parameters:

ATDS Test ID:	Test Date	ETW:	AHP:
N1C014082	5/1/2000	4000	7.0

Test Comments: Baseline

THC (g/mi)	CO (g/mi)	NOx(g/mi)	CO2 (g/mi)	Fuel Economy (MPG)
FTP Test Results:				
0.259	0.844	0.889	674.719	13.121

Test #2

Test Parameters:

ATDS Test ID:	Test Date	ETW:	AHP:
N1C014097	5/8/2000	4000	7.0

Test Comments: With Fitch Fuel Catalyst after 500 miles

THC (g/mi)	CO (g/mi)	NOx(g/mi)	CO2 (g/mi)	Fuel Economy (MPG)
FTP Test Results:				
0.265	0.984	0.899	631.610	13.967



Test #3

Test Parameters:

ATDS Test ID:	Test Date	ETW:	AHP:
NIC014134	6/2/2000	4000	7.0

Test Comments: After 2nd 500 mile Mileage Accumulation

THC (g/mi)	CO (g/mi)	NOx(g/mi)	CO2 (g/mi)	Fuel Economy (MPG)
FTP Test Results:				
0.238	0.629	0.676	499.970	17.650

The following calculation was used to determine the percent change, ex. Test #1 to Test #2 with the fuel catalyst after mileage accumulation.

$$\frac{\text{Test \#1} - \text{Test \#2}}{\text{Test \#1}} \times 100$$

Percent Change

Baseline (Test #1) to After 500 miles (Test #2)

THC	CO	NOx	C02	Fuel Economy
2.32%	16.59%	1.12%	-6.39%	6.45%

Baseline (Test #1) to After 1000 miles (Test #3)

THC	CO	NOx	C02	Fuel Economy
-8.11%	-25.47%	-23.96%	-25.90%	34.52%

All tests were conducted in strict accordance with the provisions of 40 CFR 86 and/or California Title 13 and have been reviewed by ATDS' in-house Quality Auditor. Detailed test results are in the Appendix attached to this report.

Data Review and Conclusions

Based upon ATDS' review of the data above, the Fitch Fuel Catalyst installed on a Chevrolet Impala appears to show a improvement after 1000 over the road miles have been



accumulated on the vehicle with the device installed. If there is any additional information that you require or if you wish to schedule further testing, please do not hesitate to call me at the numbers below. It has been a pleasure working with Advanced Power Systems International on this project and we look forward to future efforts.

Sincerely,

James Brooks
Laboratory Supervisor
ATDS



APPENDIX



Driver = ALBERT N.

Test Start = 05/01/2000 13:48:14
 Test Finish = 05/01/2000 14:36:19

Options = Bag Cert Show-To1

Vehicle Model = 79 CHEV
 Transmission = AUTO
 Shift Point Table =

Fuel = INDOLENE
 Density(kg/l) = 0.7420
 CWF = 0.8651
 NHU = 18480.00
 R-Factor = 0.60

Shift Point Table =

Ignition System Type = DIST
 Fuel System Type = CARB

Timing =
 RPM =
 Actual HP = 7.0

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Pre Test Remarks

Test Remarks

BASELINE

Phase	THC(ppm)	CO(ppm)	NOX(ppm)	CO2(%)	FE(mpg)	Test Info	Times Info
Phase 1	100.000	500.000	30.000	2.000		Baro (inHg) = 29.05	Phase Start = 13:48:14
Sample	70.816	147.666	16.015	1.621		Temp (degF) = 74.0	Phase Finish = 13:56:49
Std Dev	0.013	0.007	0.089	0.049		WetB (degF) = 60.0	Analysis End = 14:05:01
Ambient	11.607	8.062	0.297	0.050		Ahum(gr/lb) = 55.8	
Std Dev	0.019	0.008	0.077	0.007		NOX Factor = 0.9175	
Net Conc.	60.633	140.593	15.755	1.577		Umix(ft3 20C) = 3011.36	Elapsed (sec) = 514.4
Grams/ph.	2.982	13.955	2.358	2461.494	12.809	DF = 8.154	Bag Anl (sec) = 492.6
Grams/mi.	0.829	3.881	0.656	684.613		SAD P (inAg) = 1.489	Drv Err (sec) = 0.0
Phase 2	30.000	50.000	30.000	2.000		SAD T (degF) = 79.30	Crnk Time = 9.3
Sample	19.316	5.557	14.581	1.108		SADF(ft3 20C) = 2574.49	
Std Dev	0.033	0.031	0.050	0.034		Dist (mile) = 3.595	
Ambient	16.528	5.193	0.248	0.051		Baro (inHg) = 29.05	Phase Start = 13:56:49
Std Dev	0.014	0.058	0.156	0.005		Temp (degF) = 74.0	Phase Finish = 14:11:21
Net Conc.	4.157	0.794	14.354	1.061		WetB (degF) = 60.0	Analysis End = 14:18:16
Grams/ph.	0.346	0.133	3.636	2802.207	12.216	Ahum(gr/lb) = 55.8	
Grams/mi.	0.090	0.035	0.943	726.643		NOX Factor = 0.9175	Elapsed (sec) = 872.4
Phase 3	30.000	50.000	30.000	2.000		Umix(ft3 20C) = 5097.21	Bag Anl (sec) = 415.1
Range	26.973	5.151	23.544	1.369		DF = 12.072	Drv Err (sec) = 0.0
Sample	0.019	0.036	0.090	0.042		SAD P (inAg) = 1.610	Phase Start = 14:11:21
Std Dev	17.809	2.682	0.173	0.048		SAD T (degF) = 80.97	Phase Finish = 14:28:57
Ambient	10.020	0.046	0.039	0.007		SADF(ft3 20C) = 4547.21	Analysis End = 14:36:19
Std Dev	10.988	2.743	23.388	1.326		Dist (mile) = 3.856	
Net Conc.	8.534	0.268	3.453	2083.688	15.581	Baro (inHg) = 29.05	Elapsed (sec) = 502.2
Grams/ph.	0.259	0.844	0.889	674.719	13.121	Temp (degF) = 74.0	Bag Anl (sec) = 442.2
Grams/mi.	0.066	0.214	0.226	563.408		WetB (degF) = 60.0	Drv Err (sec) = 0.3
Weighted Results						Ahum(gr/lb) = 55.8	Phase Start = 14:20:30
Grams g/mi						NOX Factor = 0.9175	Phase Finish = 14:28:57
						Umix(ft3 20C) = 2974.19	Analysis End = 14:36:19
						DF = 9.766	Elapsed (sec) = 502.2
						SAD P (inAg) = 1.545	Bag Anl (sec) = 442.2
						SAD T (degF) = 80.95	Drv Err (sec) = 0.3
						SADF(ft3 20C) = 2583.81	
						Dist (mile) = 3.589	

Driver = WILLY U T
 Test = EPA 75
 Test Start = 05/08/2000 11:45:59
 Test Finish = 05/08/2000 12:33:31
 Options = Bag Cert Show-Tol

Vehicle Model = 79 IMPALA
 Transmission = AUTO
 Shift Point Table =
 Ignition System Type = DIST
 Fuel System Type = CARB
 Inertia = 4000 lb
 Actual HP = 7.0

Fuel = GASOLINE PH-2
 Density(kg/l) = 0.7390
 CWF = 0.8541
 NHU = 18128.00
 R-Factor = 0.60

Shift Point Table =

Pre Test Remarks
 Post Test Remarks

WILLY FITCH FUEL CATALYST AFTER 500 MILE S

Phase 1
 Range
 Sample
 Std Dev
 Ambient
 Std Dev
 Net Conc.
 Grams/ph.
 Grams/mi.

THC(ppm)	CO(ppm)	NOX(ppm)	CO2(%)	FE(mpg)
100.000	500.000	30.000	2.000	12.900
67.944	156.586	16.761	1.613	
0.037	0.022	0.101	0.058	
7.022	4.216	0.179	0.010	
57.778	152.885	16.803	1.562	
2.842	15.174	2.870	2437.875	
0.789	4.216	0.797	677.331	

Phase 2
 Range
 Sample
 Std Dev
 Ambient
 Std Dev
 Net Conc.
 Grams/ph.
 Grams/mi.

THC(ppm)	CO(ppm)	NOX(ppm)	CO2(%)	FE(mpg)
30.000	50.000	30.000	2.000	13.247
11.677	2.034	12.129	1.011	
0.028	0.074	0.032	0.007	
7.296	1.086	0.144	0.048	
0.008	0.048	0.068	0.006	
4.931	1.030	11.996	0.966	
0.415	0.175	3.504	2578.592	
0.107	0.045	0.908	668.076	

Phase 3
 Range
 Sample
 Std Dev
 Ambient
 Std Dev
 Net Conc.
 Grams/ph.
 Grams/mi.

THC(ppm)	CO(ppm)	NOX(ppm)	CO2(%)	FE(mpg)
30.000	50.000	30.000	2.000	16.724
18.088	12.554	20.379	1.264	
0.019	0.082	0.061	0.025	
6.440	1.287	0.122	0.042	
0.018	0.115	0.042	0.003	
12.257	11.389	20.268	1.221	
0.601	1.128	3.453	1901.133	
0.167	0.313	0.960	528.476	

Weighted Results
 Grams/g/mi

0.265	0.984	0.899	631.610	13.967
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Test Info

Baro (inHg)	= 29.14	Phase Start	= 11:45:59
Temp (degF)	= 77.0	Phase Finish	= 11:54:31
WetB (degF)	= 67.0	Analysis End	= 12:02:16
Ahum(gr/lb)	= 84.5	Elapsed (sec)	= 511.9
NOX Factor	= 1.0470	Bag Anl (sec)	= 464.6
VMix(ft3 20C)	= 3011.11	Drv Err (sec)	= 0.0
DF	= 8.195	Crank Time	= 6.8
SAO P (inAq)	= 1.445		
SAO T (degF)	= 78.14		
SAOF(ft3 20C)	= 2532.99		
Dist (mile)	= 3.599		

Test Info

Baro (inHg)	= 29.14	Phase Start	= 11:54:31
Temp (degF)	= 77.0	Phase Finish	= 12:09:03
WetB (degF)	= 67.0	Analysis End	= 12:17:00
Ahum(gr/lb)	= 84.5	Elapsed (sec)	= 822.4
NOX Factor	= 1.0469	Bag Anl (sec)	= 477.1
VMix(ft3 20C)	= 5150.35	Drv Err (sec)	= 0.0
DF	= 13.240		
SAO P (inAq)	= 1.629		
SAO T (degF)	= 78.12		
SAOF(ft3 20C)	= 4597.65		
Dist (mile)	= 3.860		

Test Info

Soak Start	= 12:09:03
Soak Finish	= 12:18:10
Elapsed (sec)	= 546.9

Test Info

Baro (inHg)	= 29.14	Phase Start	= 12:18:10
Temp (degF)	= 77.0	Phase Finish	= 12:26:37
WetB (degF)	= 67.0	Analysis End	= 12:33:31
Ahum(gr/lb)	= 84.5	Elapsed (sec)	= 507.0
NOX Factor	= 1.0470	Bag Anl (sec)	= 413.9
VMix(ft3 20C)	= 3003.75	Drv Err (sec)	= 0.3
DF	= 10.574	Crank Time	= 1.9
SAO P (inAq)	= 1.562		
SAO T (degF)	= 78.61		
SAOF(ft3 20C)	= 2611.47		
Dist (mile)	= 3.597		



Driver

= ALBERT N.

Test Start = 06/02/2000 10:10:13

Test Finish = 06/02/2000 10:58:14

Test = EPA 75

Options = Bag Cert Show-Tol

Vehicle Model = 79 CHEV.

Vehicle ID No. = 1L69L9C130404

Transmission = AUTO

Eng. Disp. = 5.7 L.

Shift Point Table=

Shift Point Table=

Ignition System Type= DIST

Timing =

Fuel System Type= CARB

RPM =

Intia = 4000 lb

Actual HP = 5.9

Fuel = GASOLINE PH-2
Density(kg/l) = 0.7390
CWF = 0.8541
NHV = 18128.00
R-Factor = 0.60

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Phase 1	THC(ppm)	CO(ppm)	NOX(ppm)	CO2(%)	FE(mpg)
100.000	50.000	30.000	2.000	29.15	Phase Start = 10:10:13
55.890	104.231	13.033	1.226	75.0	Phase Finish = 10:18:40
0.021	0.008	0.066	0.030	65.0	Analysis End = 10:28:19
11.638	10.833	0.533	0.096	77.6	Elapsed (sec) = 506.7
0.007	0.009	0.034	0.005	1.0125	Bag Anl (sec) = 579.7
45.330	94.402	12.549	1.139	3065.01	Drv Erf. (sec) = 0.8
2.269	9.537	2.110	1808.517	10.790	Crank Time = 11.6
0.630	2.649	0.586	502.392	17.413	

Test Info	Times Info
Baro (inHg) = 29.15	Phase Start = 10:10:13
Temp (degF) = 75.0	Phase Finish = 10:18:40
WetB (degF) = 65.0	Analysis End = 10:28:19
Ahum(gr/lb) = 77.6	Elapsed (sec) = 506.7
NOX Factor = 1.0125	Bag Anl (sec) = 579.7
Umix(ft3 20C) = 3065.01	Drv Erf. (sec) = 0.8
DF = 10.790	Crank Time = 11.6
SAD P (inAq) = 1.628	
SAD T (degF) = 78.36	
SADF(ft3 20C) = 2718.30	
Dist (mile) = 3.600	

Phase 2	THC(ppm)	CO(ppm)	NOX(ppm)	CO2(%)	FE(mpg)
30.000	50.000	30.000	2.000	29.15	Phase Start = 10:19:40
19.138	4.126	9.951	0.882	75.0	Phase Finish = 10:53:13
0.018	0.039	0.035	0.023	65.0	Analysis End = 10:40:42
14.931	3.938	0.758	0.110	77.6	Elapsed (sec) = 872.6
0.009	0.049	0.054	0.008	1.0125	Bag Anl (sec) = 449.2
5.193	0.448	9.244	0.780	5161.03	Drv Erf. (sec) = 0.0
0.438	0.076	2.617	2085.426	15.148	
0.113	0.020	0.675	538.060	17.719	

Test Info	Times Info
Baro (inHg) = 29.15	Phase Start = 10:19:40
Temp (degF) = 75.0	Phase Finish = 10:53:13
WetB (degF) = 65.0	Analysis End = 10:40:42
Ahum(gr/lb) = 77.6	Elapsed (sec) = 872.6
NOX Factor = 1.0125	Bag Anl (sec) = 449.2
Umix(ft3 20C) = 5161.03	Drv Erf. (sec) = 0.0
DF = 15.148	
SAD P (inAq) = 1.719	
SAD T (degF) = 78.94	
SADF(ft3 20C) = 4723.32	
Dist (mile) = 3.876	

Phase 3

Range	THC(ppm)	CO(ppm)	NOX(ppm)	CO2(%)	FE(mpg)
30.000	50.000	30.000	2.000	29.15	Phase Start = 10:42:15
22.933	11.142	16.830	1.048	75.0	Phase Finish = 10:50:42
0.026	0.110	0.052	0.021	65.0	Analysis End = 10:58:14
10.611	2.023	0.588	0.069	77.6	Elapsed (sec) = 506.2
0.047	0.019	0.006	0.004	1.0125	Bag Anl (sec) = 452.0
13.154	9.278	16.289	0.984	3002.31	Drv Erf. (sec) = 0.0
0.645	0.918	2.682	1530.311	12.750	
0.180	0.256	0.747	426.064	17.901	

Test Info	Times Info
Baro (inHg) = 29.15	Phase Start = 10:42:15
Temp (degF) = 75.0	Phase Finish = 10:50:42
WetB (degF) = 65.0	Analysis End = 10:58:14
Ahum(gr/lb) = 77.6	Elapsed (sec) = 506.2
NOX Factor = 1.0125	Bag Anl (sec) = 452.0
Umix(ft3 20C) = 3002.31	Drv Erf. (sec) = 0.0
DF = 12.750	Crank Time = 1.0
SAD P (inAq) = 1.668	
SAD T (degF) = 79.01	
SADF(ft3 20C) = 2696.08	
Dist (mile) = 3.592	

Weighted Results

Grams/gmi 0.238 0.629 0.676 499.970 17.650