



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 = EPA 75
 Vehicle Model = 79 CHEV
 Transmission = AUTO
 Shift Point Table =
 Ignition System Type = DIST
 Fuel System Type = CARB
 Inertia = 4000 lb

Test Start = 05/01/2000 13:48:14
 Test Finish = 05/01/2000 14:36:19
 Options = Bag Cert Show-To1
 Vehicle ID No. = 1L69L9C130404
 Eng. Disp. = 5.7 L.
 Shift Point Table =
 Timing =
 RPM =
 Actual HP = 7.0

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

Shift Point Table =

400 South Eglar Avenue • Ontario, CA 91761
 Tel (909) 390-1100 • Fax (909) 390-9056

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
	70.816	147.666	16.015	1.621		Temp (degF) = 74.0	Phase Finish = 13:56:49
	0.013	0.007	0.089	0.049		WetB (degF) = 60.0	Analysis End = 14:05:01
	11.607	8.062	0.297	0.050		AHum(gr/lb) = 55.8	
	0.019	0.008	0.077	0.007		NOX Factor = 0.9175	
	60.633	140.593	15.755	1.577		Umix(ft3 20C) = 3011.36	Elapsed (sec) = 514.4
	2.982	13.955	2.358	2461.494	12.809	DF (inHg) = 8.154	Bag Anl (sec) = 492.6
	0.829	3.881	0.656	684.613		SAD P (inAg) = 1.489	Drv Err (sec) = 0.0
						SAD T (degF) = 79.30	Crank Time = 9.3
						SADF(ft3 20C) = 2574.49	
						Dist (mile) = 3.595	
Phase 2	30.000	50.000	30.000	2.000		Baro (inHg) = 29.05	Phase Start = 13:56:49
	19.316	5.557	14.581	1.108		Temp (degF) = 74.0	Phase Finish = 14:11:21
	0.033	0.031	0.050	0.034		WetB (degF) = 60.0	Analysis End = 14:18:16
	16.528	5.193	0.248	0.051		AHum(gr/lb) = 55.8	
	0.014	0.058	0.156	0.005		NOX Factor = 0.9175	
	4.157	0.794	14.354	1.061		Umix(ft3 20C) = 5097.21	Elapsed (sec) = 872.4
	0.346	0.133	3.636	2802.207	12.216	DF (inHg) = 12.072	Bag Anl (sec) = 415.1
	0.090	0.035	0.943	726.643		SAD P (inAg) = 1.610	Drv Err (sec) = 0.0
						SAD T (degF) = 80.97	
						SADF(ft3 20C) = 4547.21	
						Dist (mile) = 3.856	
Phase 3	30.000	50.000	30.000	2.000		Baro (inHg) = 29.05	Phase Start = 14:11:21
	26.973	5.151	23.544	1.369		Temp (degF) = 74.0	Phase Finish = 14:28:57
	0.019	0.036	0.090	0.042		WetB (degF) = 60.0	Analysis End = 14:36:19
	17.809	2.682	0.173	0.048		AHum(gr/lb) = 55.8	
	0.020	0.046	0.039	0.007		NOX Factor = 0.9175	
	10.988	2.743	23.388	1.326		Umix(ft3 20C) = 2974.19	Elapsed (sec) = 502.2
	0.534	0.262	0.453	2043.682	15.581	DF (inHg) = 9.766	Bag Anl (sec) = 442.2
						SAD P (inAg) = 1.545	Drv Err (sec) = 0.3
						SAD T (degF) = 80.95	
						SADF(ft3 20C) = 2583.81	
						Dist (mile) = 3.589	
Weighted Results	0.259	0.844	0.889	674.719	13.121		

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 U T 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
Temp (degF)	= 77.0
WetB (degF)	= 67.0
Ahum(gr/lb)	= 84.5
NOX Factor	= 1.0470
VMix(ft3 20C)	= 3011.11
DF	= 8.195
SAO P (inAq)	= 1.445
SAO T (degF)	= 78.14
SAOF(ft3 20C)	= 2532.99
Dist (mile)	= 3.599

Times Info

Phase Start	= 11:45:59
Phase Finish	= 11:54:31
Analysis End	= 12:02:16
Elapsed (sec)	= 511.9
Bag Anl (sec)	= 464.6
Drv Err (sec)	= 0.0
Crank Time	= 6.8

Test Info

Baro (inHg)	= 29.14
Temp (degF)	= 77.0
WetB (degF)	= 67.0
Ahum(gr/lb)	= 84.5
NOX Factor	= 1.0469
VMix(ft3 20C)	= 5150.35
DF	= 13.240
SAO P (inAq)	= 1.629
SAO T (degF)	= 78.12
SAOF(ft3 20C)	= 4597.65
Dist (mile)	= 3.860

Times Info

Phase Start	= 11:54:31
Phase Finish	= 12:09:03
Analysis End	= 12:17:00
Elapsed (sec)	= 822.4
Bag Anl (sec)	= 477.1
Drv Err (sec)	= 0.0

Test Info

Baro (inHg)	= 29.14
Temp (degF)	= 77.0
WetB (degF)	= 67.0
Ahum(gr/lb)	= 84.5
NOX Factor	= 1.0470
VMix(ft3 20C)	= 3003.75
DF	= 10.574
SAO P (inAq)	= 1.562
SAO T (degF)	= 78.61
SAOF(ft3 20C)	= 2611.47
Dist (mile)	= 3.597

Times Info

Phase Start	= 12:18:10
Phase Finish	= 12:33:31
Analysis End	= 12:33:31
Elapsed (sec)	= 507.0
Bag Anl (sec)	= 413.9
Drv Err (sec)	= 0.3
Crank Time	= 1.9



Driver = ALBERT N.

Test Start = 06/02/2000 10:10:13
 Test Finish = 06/02/2000 10:58:14

Options = Bag Cert Show-Tol

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

Shift Point Table =

Ignition System Type = DIST
 Fuel System Type = CARB

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

Initialia = 4000 lb Actual HP = 5.9

Test Remarks

Test Remarks

TESTER 2ND 500 MILE MILEAGE ACC.

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THC(ppm) CO(ppm) NOX(ppm) CO2(%) FE(mpg)

Phase 1		Test Info		Times Info	
100.000	50.000	Baro (inHg)	29.15	Phase Start	10:10:13
55.890	104.231	Temp (degF)	75.0	Phase Finish	10:18:40
0.021	0.008	WetB (degF)	65.0	Analysis End	10:28:19
11.638	10.833	Ahum(gr/lb)	77.6	Elapsed (sec)	506.7
0.007	0.009	NOX Factor	1.0125	Bag Anl (sec)	579.7
45.330	94.402	Umix(ft3 20C)	3065.01	Drv Erf. (sec)	0.8
2.269	9.537	DF	10.790	Crank Time	11.6
0.630	2.649	SAD P (inAq)	1.628		
		SAD T (degF)	78.36		
		SADF(ft3 20C)	2718.30		
		Dist (mile)	3.600		

THC(ppm) CO(ppm) NOX(ppm) CO2(%) FE(mpg)

Phase 2		Test Info		Times Info	
30.000	50.000	Baro (inHg)	29.15	Phase Start	10:19:40
19.138	4.126	Temp (degF)	75.0	Phase Finish	10:53:13
0.018	0.039	WetB (degF)	65.0	Analysis End	10:40:42
14.931	3.938	Ahum(gr/lb)	77.6	Elapsed (sec)	872.6
0.009	0.049	NOX Factor	1.0125	Bag Anl (sec)	449.2
5.193	0.448	Umix(ft3 20C)	5161.03	Drv Err (sec)	0.0
0.438	0.076	DF	15.148		
0.113	0.020	SAD P (inAq)	1.719		
		SAD T (degF)	78.94		
		SADF(ft3 20C)	4723.32		
		Dist (mile)	3.876		

THC(ppm) CO(ppm) NOX(ppm) CO2(%) FE(mpg)

Phase 3		Test Info		Times Info	
30.000	50.000	Baro (inHg)	29.15	Phase Start	10:42:15
22.933	11.142	Temp (degF)	75.0	Phase Finish	10:50:42
0.026	0.110	WetB (degF)	65.0	Analysis End	10:58:14
10.611	2.023	Ahum(gr/lb)	77.6	Elapsed (sec)	506.2
0.047	0.019	NOX Factor	1.0125	Bag Anl (sec)	452.0
13.154	9.278	Umix(ft3 20C)	3002.31	Drv Erf. (sec)	0.0
0.645	0.918	DF	12.750	Crank Time	1.2
0.180	0.256	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

