Ref

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FUEL CONSUMPTION, EMISSIONS AND POWER CHARACTERISTICS OF THE 1975 CHEVROLET 350-CID 2V AUTOMOTIVE ENGINE - EXPERIMENTAL DATA

U. S. Energy Research and Development
Bartlesville Energy Research Center
P.O. Box 1398
Bartlesville OK 74003

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INTERIM REPORT

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16. Abstract

Experimental data were obtained in dynamometer tests of the 1975 Chevrolet, 350 cubic-inch displacement, 2-bbl engine, to determine the steady-state fuel consumption and emissions of hydrocarbon, carbon monoxide and oxides of nitrogen. These data were obtained in detail adequate to construct performance maps for the entire speed/load operating range of the engine.

The objective of the test work was to obtain data that describe engine performance characteristics in engineering terms; the data are so presented. The comparative or judgmental assessment of engine performance was not an objective and such assessment is avoided.

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PREFACE

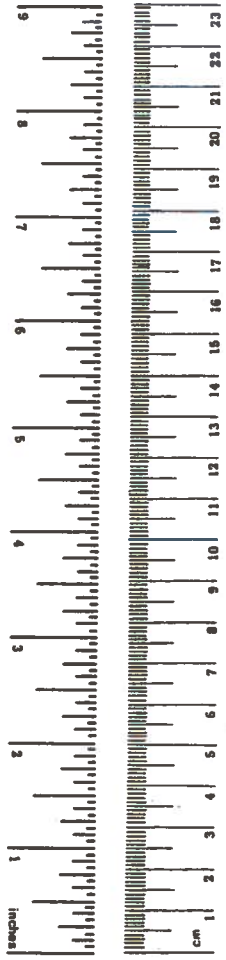
This report, prepared by the U.S. Energy Research and Development Administration, Bartlesville Energy Research Center for the U.S. Department of Transportation, Transportation Systems Center, Power and Propulsion Branch, Cambridge MA, presents results of an automobile engine test. This represents one of a series of 1975 engines tested.

Mr. Ralph G. Colello is the technical monitor of this project.

METRIC CONVERSION FACTORS

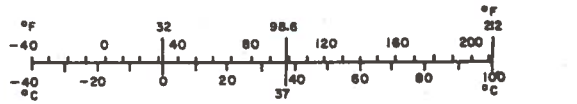
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



1. INTRODUCTION

Data acquired from tests of a 1975 Chevrolet V8, 350-CID (2 bbl carburetor) engine are presented in this report. This engine is used by Chevrolet in a wide range of vehicle sizes covering compacts (Nova) to full-size vehicles. The test results are sufficient to establish the steady-state maps for fuel consumption and emissions (carbon monoxide, hydrocarbon, oxides of nitrogen) over the entire operating range of the engine. In addition, sulfate levels were determined at selected operating modes. This engine is one of a series tested or to be tested.

The objective of this program is to obtain engine performance data for estimating emissions and fuel economy in varied service and duty. The intent of this work is to provide basic engine characteristic data required as input for engineering calculations involving ground transportation.

2. ENGINE TEST REPORT

The specifications of the Chevrolet 350-CID, 2V engine are given in table 1. A single batch of nonleaded regular grade gasoline was used throughout the test; fuel specifications are given in table 2. The engine was operated at various speeds and loads over a 38-hour period for break-in; details of break-in are given in table 3. The total engine operating time was about 80 hours. The period of testing was May 22 through June 10, 1975.

The engine was mounted on a test stand and coupled to an eddy-current dynamometer. The engine was complete except for fan (a cooling tower was used instead of a radiator). An alternator was included in the test setup, but was not wired into the electrical system. Emission control systems included in the installation were oxidation catalyst, exhaust gas recirculation (EGR), early fuel evaporation, and high energy ignition. The engine was operated at the following steady-state modes:

Speeds: 1,000; 1,300; 1,500; 1,900; 2,200; 2,800; 3,300; 3,800 rpm

Loads: 0, 10, 25, 40, 60, 75, 90, 100 pct of full load (repeats of 0, 25, 75, 100 pct of full load)

Idle speed loads: 0, 5, 10, 15 bhp (repeats at 0 load)

Total number of test modes.....	69
Repeats.....	34
Total number of tests.....	103

The following data were recorded:

Test number
Date
Barometric pressure, mm Hg
Dew point, °F -- Panametrics hygrometer
Inlet air temperature, °F
Speed, rpm
Torque, lb-ft -- BLH strain gage load cell; Daytronics indicator
Fuel rate, lb/hr -- FLO-TRON linear mass flowmeter and Fluidyne positive displacement flowmeter
Ignition timing, °BTC
Manifold vacuum, in. Hg
Throttle angle, degrees
CO, pct -- Beckman NDIR
CO_2, pct -- Beckman NDIR

O_2, pct -- Beckman polarographic detector
HC, ppmC -- Custom-built heated flame ionization detector
NO_x, ppmC -- Thermo-Electron chemiluminescent detector
Oil temperature, °F
Oil pressure, psig
Coolant temperature, °F
Exhaust temperature, °F
Exhaust pressure, in. H_2O

The computed data include absolute humidity (grains/lb dry air); power (bhp); air-fuel ratio; and mass emission rates of carbon monoxide (CO), unburned hydrocarbons (HC), and oxides of nitrogen (NO_x) in grams/hour. Sulfate levels were determined by the barium chloranilate method. The following equations were applied in the computations:

$$W = \exp\left[12.02\left(\frac{D - 1.4}{D + 212}\right)\right]$$

$$H = \frac{4348\ W}{B - W}$$

$$P = \left(\frac{N \times T}{5252}\right)\left(\frac{736.6}{B - W}\right)\left(\frac{t + 460}{545}\right)^{0.5}$$

$$A/F = 4.895\ \frac{(CO) + 2(CO_2) + 2(O_2) + \left(\frac{NO_x}{10^4}\right) + 3.148\ (CO_2)\left(\frac{CO + CO_2}{CO + 3CO_2}\right)}{(CO) + (CO_2) + \left(\frac{HC}{10^4}\right)\left[1 + .03148\ (CO_2)\left(\frac{CO + CO_2}{CO + 3CO_2}\right)\right]}$$

The equation for A/F is based on:

1. Fuel = $CH_{2.099}$
2. Water-gas-shift equilibrium constant = $\frac{(CO)\ (H_2O)}{(CO_2)\ (H_2)} = 3$
3. HC was determined on a raw exhaust basis, all other species measured on a dry basis.
4. All NO_x is NO.

Mass CO = (Exhaust flow rate) x (CO)

$$\times \frac{\text{Mol. wt CO}}{\text{Mol. wt exhaust}} \times \text{correction for water removal}$$

$$\text{Mass CO} = 4.383\ (F)\ (A/F + 1)\ (CO)\left[\frac{1}{1 + .03148\ (CO_2)\left(\frac{CO + CO_2}{CO + 3CO_2}\right)}\right]$$

$$\text{Mass HC} = 0.0002207\ (F)\ (A/F + 1)\ (HC)$$

$$\text{Mass } NO_x = 0.0007201\ (F)\ (A/F + 1)\ (NO_x)\left[\frac{1}{1 + .03148\ (CO_2)\left(\frac{CO + CO_2}{CO + 3CO_2}\right)}\right]^x$$

$$K_H = \frac{1}{1 - .0047\ (H - 75)}$$

$$\text{Mass } H_2SO_4 = 0.001534\ (F)\ (A/F + 1)\ (SO_3)$$

where A/F = air-fuel ratio

B = barometric pressure, mm Hg

CO = carbon monoxide concentration, vol pct

CO_2 = carbon dioxide concentration, vol pct

D = intake air dew point, °F

F = fuel rate, lb/hr

H = humidity, grains H_2O/lb dry air

HC = unburned hydrocarbon concentration, ppmC, vol

K_H = humidity correction factor

N = engine speed, rpm

NO = nitric oxide concentration, ppm, vol

NO_x = nitrogen oxides concentration, ppm, vol

O_2 = oxygen concentration, vol pct

P = corrected power, brake horsepower

SO_3 = sulphate concentration, ppm

t = intake air temperature, °F

T = torque, ft-lb

W = water vapor pressure, mm Hg

TABLE 1. - Manufacturer's engine specifications

Displacement:	350 cubic inches
Maximum horsepower:	145 hp at 3,800 rpm
Maximum torque:	250 lb-ft at 2,200 rpm
Bore and stroke:	4.00 in x 3.48 in
Compression ratio:	8.5

TABLE 2. - Fuel specifications

Fuel No.	7516
Research octane No.	91.0
Motor octane No.	83.5
Reid vapor pressure, psig. (by micro vapor pressure test)	9.86
Distillation, °F:	
10 pct.	125
50 pct.	212
95 pct.	390
100 pct.	416
API gravity, °.	66.1
FIA analysis, pct:	
Aromatics.	11
Olefins.	15
Paraffins.	74
Sulfur, pct.	0.0288
Lead, g/gallon.	Trace

TABLE 3. - Engine break-in schedule

Simulated vehicle speed, mph	Engine speed, rpm	Manifold vacuum, in. Hg	Time in mode, hr
20	1,100	15.3	1/2
40	1,550	14.8	"
55	2,050	13.9	"
30	1,200	14.9	"
50	1,875	14.2	"
55	2,050	13.9	"
45	1,700	14.5	"
35	1,350	14.8	"
55	2,050	13.9	"
30	1,200	14.9	"
20	1,100	15.3	"

Total mileage per cycle = 217.5 miles.

Total mileage for 38-hour break-in period = 1,500 miles.

3. DISCUSSION OF TEST RESULTS

Aside from air-fuel ratio, the engine performance data show fairly good repeatability. Brake horsepower, torque, and brake specific fuel consumption at wide-open throttle (WOT) for various engine speeds (figure 1) show results typical of gasoline engines and are in good agreement with specifications given in table 1. Air-fuel ratio was computed based upon exhaust gas composition; minor variations in determinations of oxygen level have a strong effect in the computation. However, even with these variations, the air-fuel ratio versus power curves are similar for all speeds (figure 2). Emissions of HC and CO were well-controlled at all modes other than WOT as a consequence of lean mixture operation and the promotion of post-combustion oxidation by the catalytic reactor (figures 3 and 4). The NO_x emissions pattern (figure 5) is typical of engine operation with enrichment near WOT conditions. Fuel consumption rate (figure 6) was nearly linear with power at all speeds and showed good repeatability except for some variations near WOT. Problems were encountered with the Flo-tron fuel flowmeter during initial testing. Measurements were later taken with Fluidyne fuel flowmeter and questionable data were revised.

Sulfate levels in the exhaust were typically less than 1 ppm. Peak levels were associated with engine modes that combined lean operation with high temperatures. With this carburetion system, these criteria were met at about 50 pct of full load. Mass emission rates of sulfates (H_2SO_4) were generally less than 1 gram per hour.

4. CONCLUSIONS

Repeatability of emission rates and fuel consumption was satisfactory for purposes of this test.

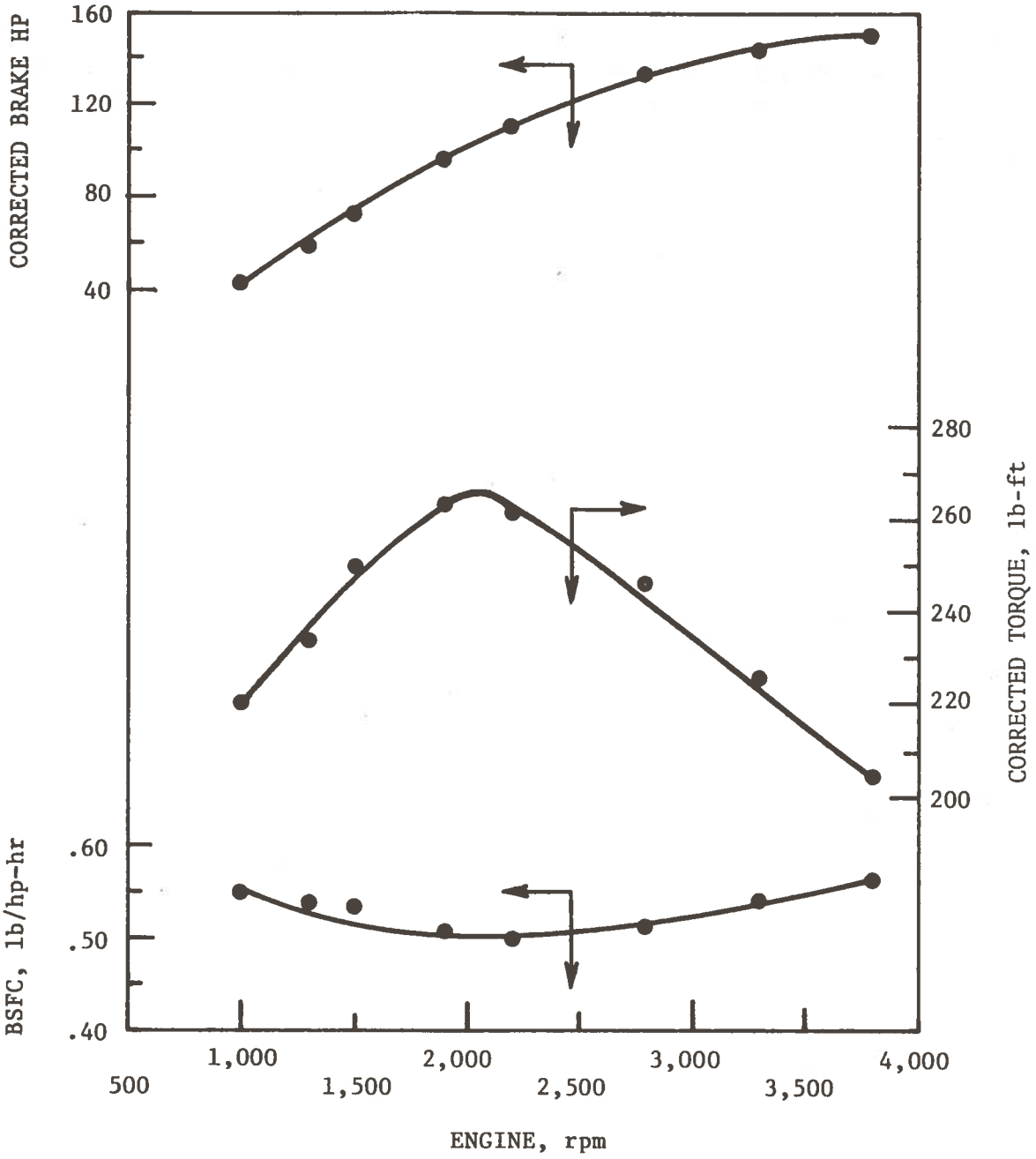


FIGURE 1. - Brake Specific Fuel Consumption, Torque, and Brake Horsepower versus Engine rpm at Wide-Open Throttle--Chevrolet 350, 2V Engine.

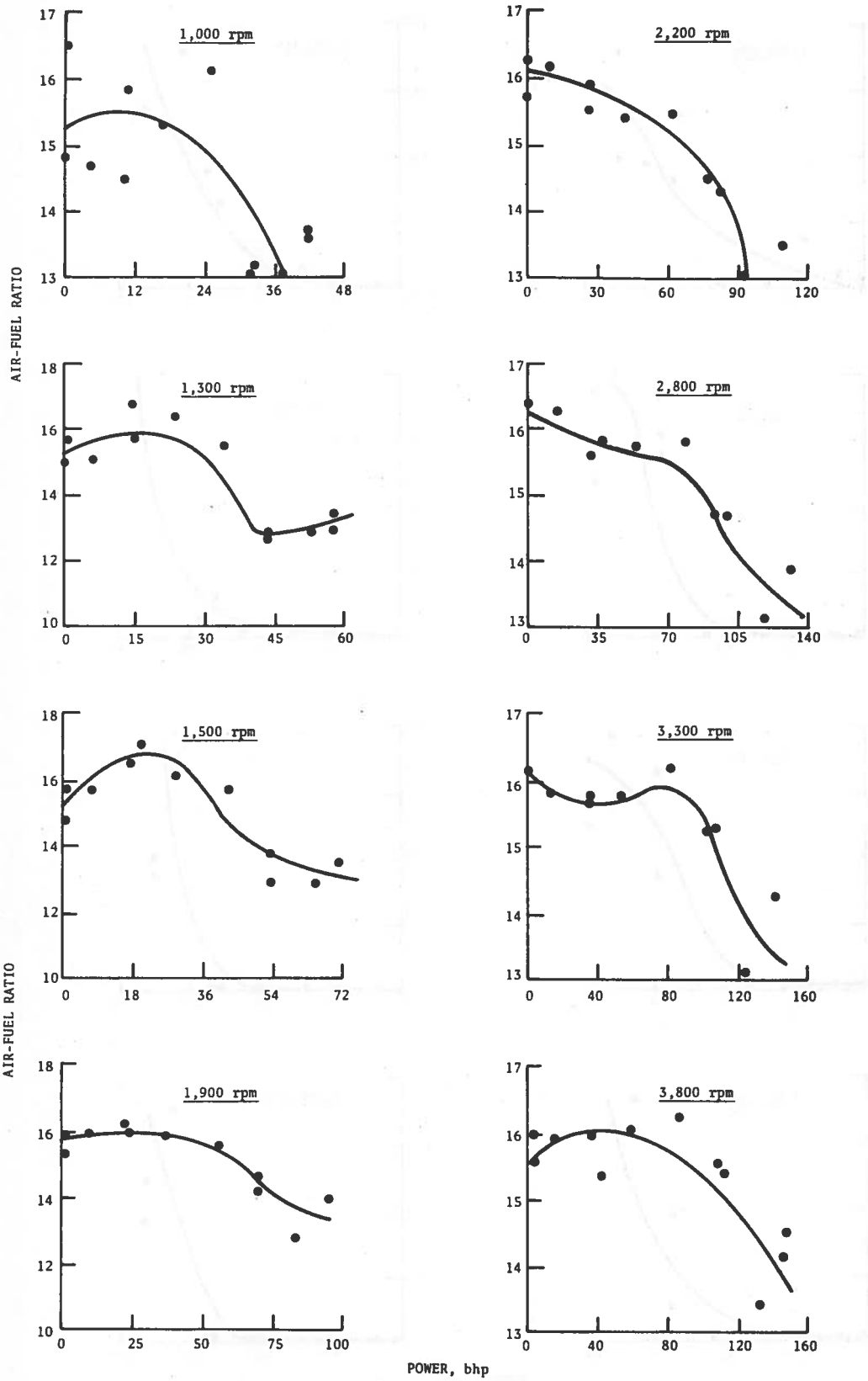


FIGURE 2. - Air-Fuel Ratio versus Power at Various Speed and Load Conditions--Chevrolet 350, 2V Engine.

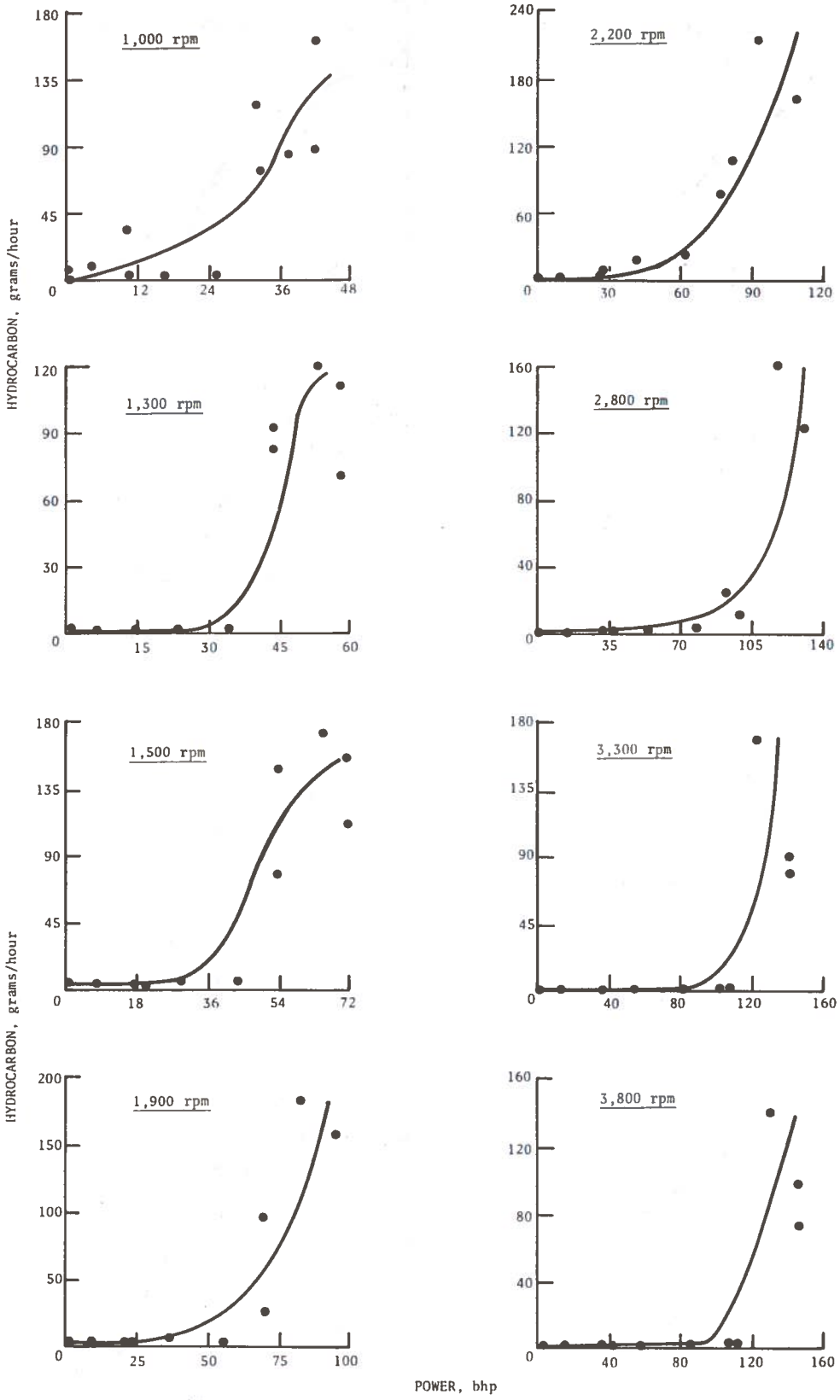


FIGURE 3. - Hydrocarbon Emissions versus Power at Various Speed and Load Conditions-- Chevrolet 350, 2V Engine.

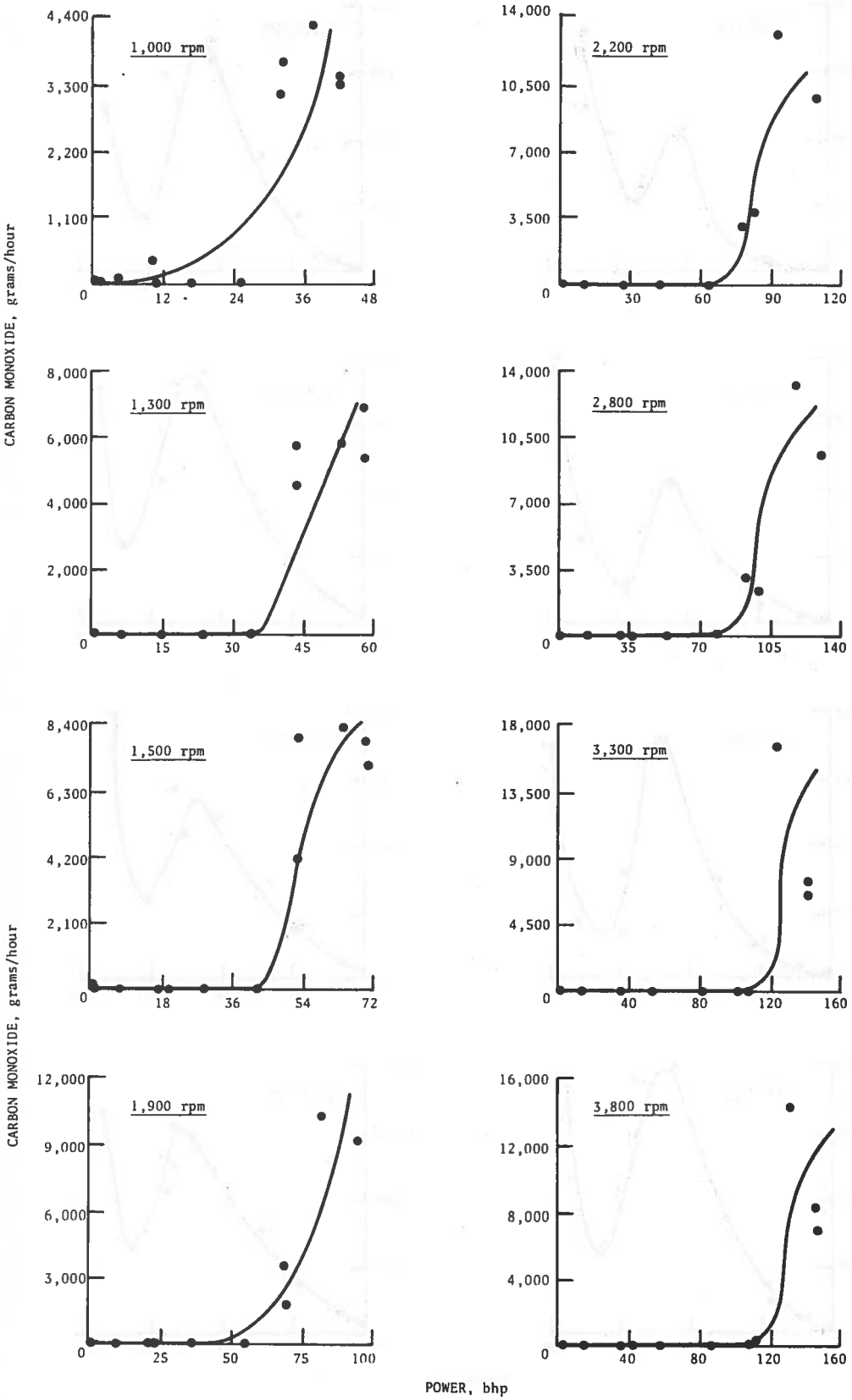


FIGURE 4. - Carbon Monoxide Emissions versus Power at Various Speed and Load Conditions-- Chevrolet 350, 2V Engine.

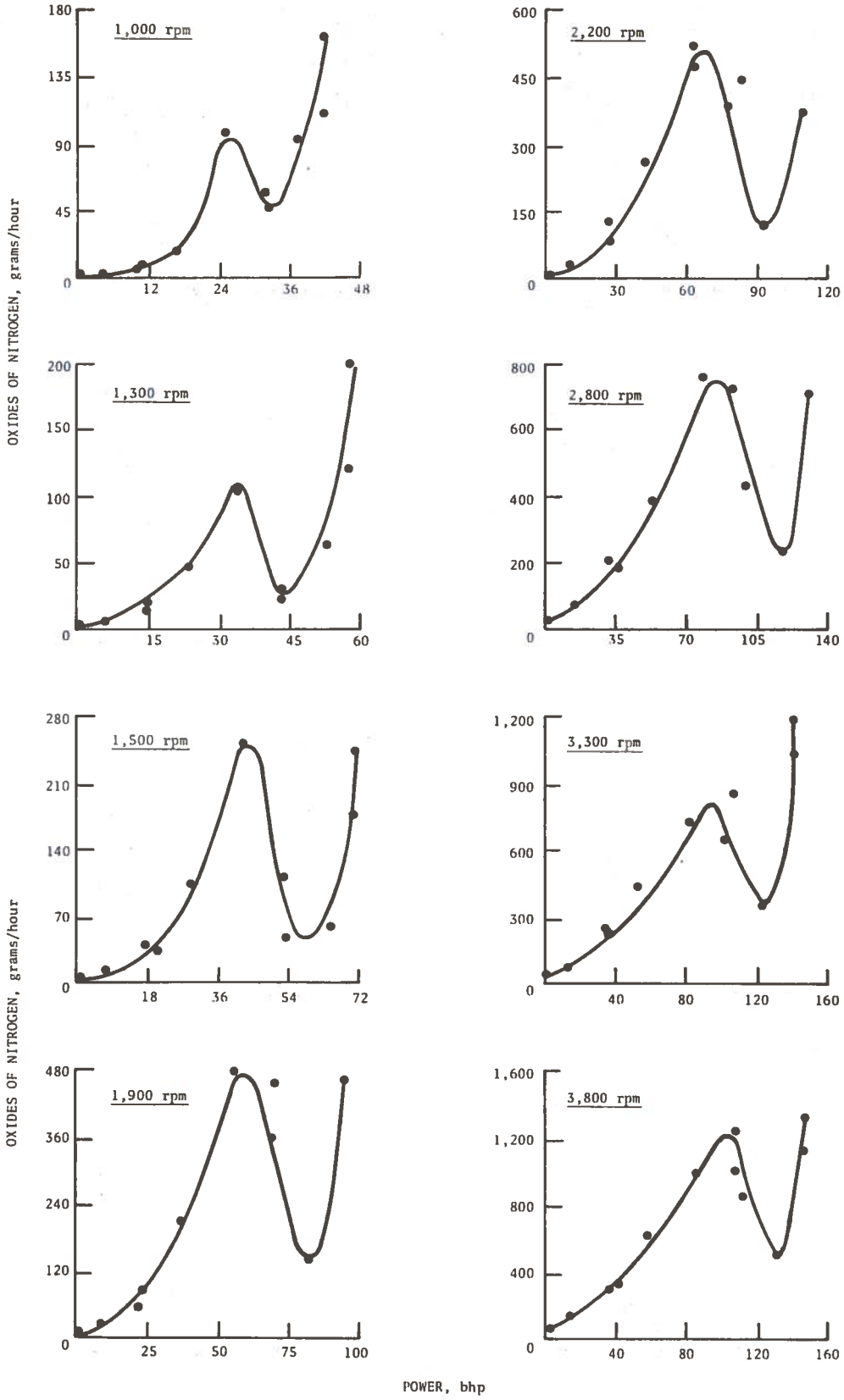


FIGURE 5. - Oxides of Nitrogen Emissions versus Power at Various Speed and Load Conditions-- Chevrolet 350, 2V Engine.

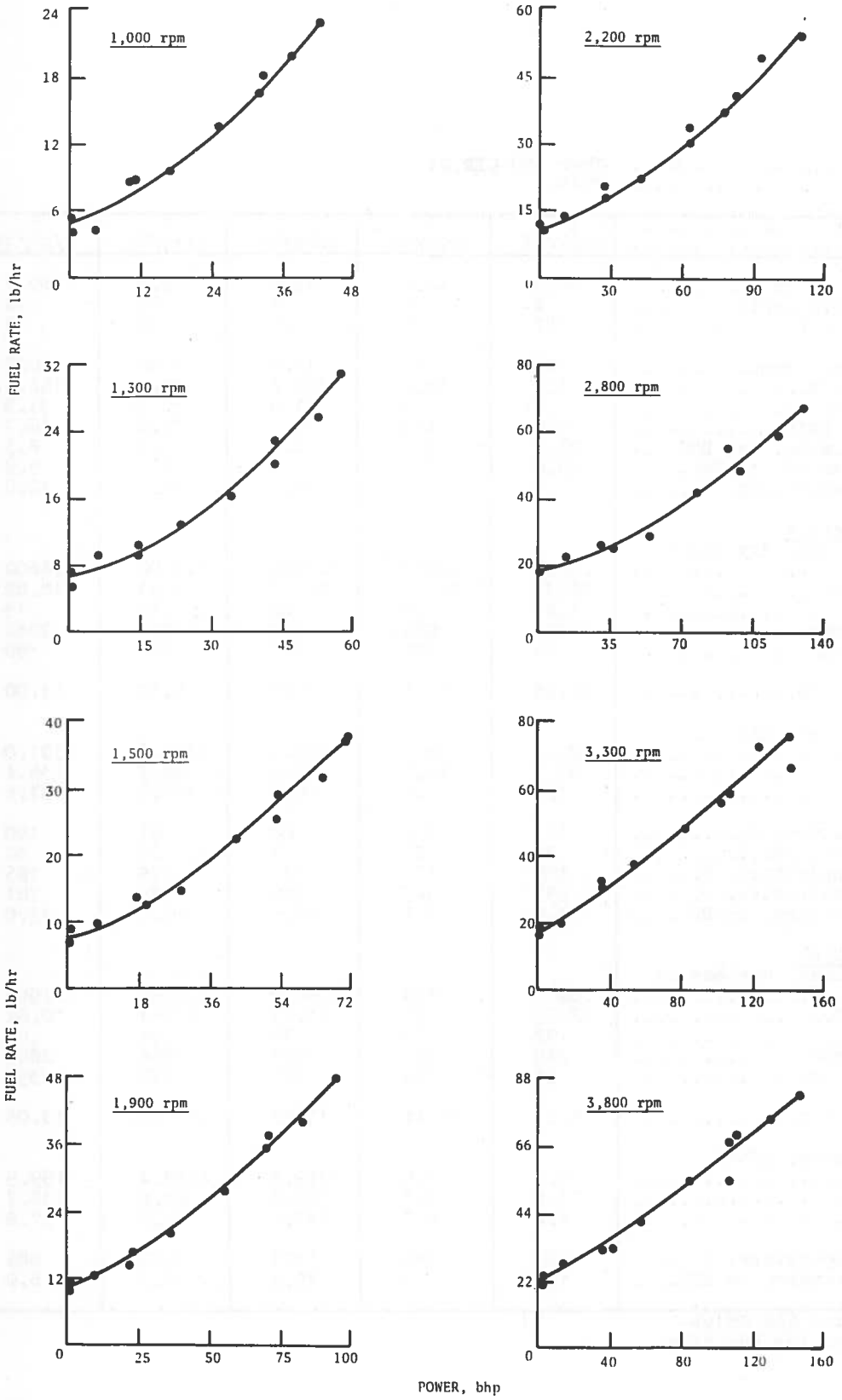


FIGURE 6. - Fuel Rate versus Power at Various Speed and Load Conditions--Chevrolet 350, 2V Engine.

Engine..... Chev 350-CID,2V
Fuel..... 7516

Test Number.....	1	2	3	4	5
Test Date.....	5/22/75	5/22/75	5/22/75	6/10/75	5/23/75
Barometer, mm Hg.....	742.6	742.6	742.6	742.5	740.7
Humidity, grains/lb.....	74	74	74	59	74
Temperature, F.....	101	96	81	80	81
Engine speed, rpm.....	800	650	1000	1000	1000
Torque, lb-ft.....	1.4	16.2	218.8	196.0	166.4
Power, bhp*.....	.2	2.0	41.9	37.4	31.9
Fuel rate, lb/hr.....	4.9	4.3	23.0	20.0	16.7
Ignition timing, deg BTC....	21.0	22.0	4.0	3.5	8.5
Manifold vacuum, in Hg.....	20.0	17.0	.5	2.0	5.9
Throttle angle, deg.....	.5	.5	75.0	29.0	12.0
Before Catalyst					
Concentrations, dry basis:					
CO, %.....	.3339	.3631	5.7300	3.9900	3.6600
CO2, %.....	12.37	12.37	10.17	11.51	10.82
O2, %.....	1.47	1.25	.28	.15	.13
HC, ppmC.....	1931	2989	3428	1807	2982
NOx, ppm.....	76	220	660	650	390
Air-fuel ratio.....	15.65	15.35	12.28	13.10	13.00
Emission rates, g/hr:					
CO.....	105.4	98.8	6726.5	4304.0	3301.0
HC.....	30.7	41.0	202.7	98.2	135.4
NOx**.....	3.9	9.8	126.7	107.3	57.6
Oil temperature, F.....	171	170	183	181	180
Oil pressure, psi.....	31	26	31	29	30
Coolant temperature, F.....	170	179	171	175	185
Exhaust temperature, F.....	537	543	959	925	781
Exhaust pressure, in H2O....	13.9	1.5	28.0	23.0	13.0
After Catalyst					
Concentrations, dry basis:					
CO, %.....	.0072	.0348	2.6000	3.9900	3.4900
CO2, %.....	12.75	12.75	11.75	11.51	10.82
O2, %.....	.92	.75	.15	.04	.05
HC, ppmC.....	219	460	2501	1566	2603
NOx, ppm.....	81	195	530	570	390
Air-fuel ratio.....	15.61	15.44	13.57	13.05	13.05
Emission rates, g/hr:					
CO.....	2.3	9.5	3349.9	4288.4	3159.9
HC.....	3.5	6.3	162.2	84.8	118.7
NOx**.....	4.2	8.7	111.6	93.8	57.8
Exhaust temperature, F.....	608	546	1121	1079	885
Exhaust pressure, in H2O....	1.5	.3	15.9	12.0	6.0

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Chev 350-CID,2V
Fuel..... 7516

Test Number.....	6	7	8	9	10
Test Date.....	5/23/75	5/23/75	5/23/75	5/23/75	5/23/75
Barometer, mm Hg.....	740.7	740.7	740.7	740.7	740.7
Humidity, grains/lb.....	74	74	74	74	74
Temperature, F.....	82	86	96	88	91
Engine speed, rpm.....	1000	1000	1000	1000	1000
Torque, lb-ft.....	130.6	86.6	52.2	22.8	1.0
Power, bhp*.....	25.1	16.7	10.2	4.4	.2
Fuel rate, lb/hr.....	13.6	9.5	8.5	4.2	5.3
Ignition timing, deg BTC....	12.5	20.0	20.0	21.5	21.0
Manifold vacuum, in Hg.....	7.1	11.9	14.0	19.5	20.5
Throttle angle, deg.....	9.8	6.0	4.0	1.9	1.0
Before Catalyst					
Concentrations, dry basis:					
CO, %.....	.0877	.2749	.9000	.7400	.6600
CO2, %.....	11.51	11.99	11.87	11.87	11.75
O2, %.....	1.70	.92	.41	.57	.65
HC, ppmC.....	1448	1879	2166	1905	1644
NOx, ppm.....	670	175	100	115	77
Air-fuel ratio.....	16.14	15.29	14.53	14.76	14.89
Emission rates, g/hr:					
CO.....	79.9	165.3	460.5	190.1	216.1
HC.....	66.4	56.9	55.8	24.6	27.1
NOx**.....	99.9	17.2	8.4	4.8	4.1
Oil temperature, F.....	180	179	175	177	175
Oil pressure, psi.....	30	31	30	31	32
Coolant temperature, F.....	169	182	182	170	180
Exhaust temperature, F.....	812	796	733	662	616
Exhaust pressure, in H20....	10.8	7.9	7.9	3.0	3.0
After Catalyst					
Concentrations, dry basis:					
CO, %.....	.0063	.0036	.7300	.3800	.1500
CO2, %.....	11.75	12.24	12.12	12.24	12.24
O2, %.....	1.45	.50	.10	.05	.05
HC, ppmC.....	76	106	1320	707	411
NOx, ppm.....	660	180	70	67	30
Air-fuel ratio.....	16.15	15.32	14.48	14.69	14.84
Emission rates, g/hr:					
CO.....	5.7	2.2	371.9	97.0	48.9
HC.....	3.5	3.2	33.9	9.1	6.7
NOx**.....	98.3	17.7	5.8	2.8	1.6
Exhaust temperature, F.....	891	821	752	672	644
Exhaust pressure, in H20....	4.5	3.0	2.0	1.0	.5

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Chev 350-CID, 2V
Fuel..... 7516

Test Number.....	11	12	13	14	15
Test Date.....	5/23/75	5/23/75	5/23/75	5/23/75	5/23/75
Barometer, mm Hg.....	740.7	740.7	740.7	740.7	740.7
Humidity, grains/lb.....	92	92	92	92	92
Temperature, F.....	79	82	84	85	85
Engine speed, rpm.....	1300	1300	1300	1300	1300
Torque, lb-ft.....	230.4	211.2	173.6	136.2	94.8
Power, bhp*.....	57.6	52.9	43.6	34.2	23.8
Fuel rate, lb/hr.....	31.0	25.8	20.2	16.3	12.9
Ignition timing, deg BTC....	7.0	8.0	14.0	15.0	25.0
Manifold vacuum, in Hg.....	.5	3.9	5.5	7.2	11.1
Throttle angle, deg.....	75.0	25.0	16.8	13.3	9.0
Before Catalyst					
Concentrations, dry basis:					
CO, %.....	3.2600	4.1500	4.5700	.3631	.1108
CO2, %.....	11.05	10.60	10.60	11.75	11.51
O2, %.....	.37	.15	.13	1.12	1.85
HC, ppmC.....	1704	2084	1937	904	889
NOx, ppm.....	820	350	320	550	310
Air-fuel ratio.....	13.47	12.89	12.74	15.54	16.31
Emission rates, g/hr:					
CO.....	5640.4	5732.6	4880.3	381.2	96.7
HC.....	148.5	145.0	104.1	47.8	39.1
NOx**.....	252.7	86.1	60.9	102.8	48.2
Oil temperature, F.....	190	194	185	187	188
Oil pressure, psi.....	32	31	31	31	32
Coolant temperature, F.....	180	179	175	179	180
Exhaust temperature, F.....	1102	1044	1059	986	921
Exhaust pressure, in H2O....	44.5	33.5	28.0	21.0	14.0
After Catalyst					
Concentrations, dry basis:					
CO, %.....	4.1500	4.2200	4.2200	.0072	.0040
CO2, %.....	10.60	10.60	10.49	11.99	11.75
O2, %.....	.07	.07	.03	.65	1.70
HC, ppmC.....	1326	1729	1529	34	45
NOx, ppm.....	410	260	125	560	310
Air-fuel ratio.....	12.90	12.84	12.81	15.47	16.35
Emission rates, g/hr:					
CO.....	6895.4	5806.6	4541.1	7.5	3.5
HC.....	110.9	119.8	82.9	1.8	2.0
NOx**.....	121.3	63.7	24.0	104.3	48.2
Exhaust temperature, F.....	1219	1142	1112	1057	971
Exhaust pressure, in H2O....	22.0	15.9	13.0	10.0	6.0

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Chev 350-CID,2V
Fuel..... 7516

Test Number.....	16	17	18	19	20
Test Date.....	5/23/75	5/23/75	5/23/75	5/23/75	5/23/75
Barometer, mm Hg.....	740.7	740.7	740.7	740.7	740.7
Humidity, grains/lb.....	92	92	92	92	92
Temperature, F.....	88	93	95	82	93
Engine speed, rpm.....	1300	1300	1300	1500	1500
Torque, lb-ft.....	59.0	24.6	1.2	244.6	221.8
Power, bhp*.....	14.9	6.2	.3	70.7	64.8
Fuel rate, lb/hr.....	10.4	9.2	7.3	37.3	31.8
Ignition timing, deg BTC....	24.0	23.0	23.5	10.0	8.5
Manifold vacuum, in Hg.....	14.5	17.0	21.0	.5	5.5
Throttle angle, deg.....	6.5	4.9	2.0	74.0	28.0
Before Catalyst					
Concentrations, dry basis:					
CO, %.....	.1945	.4496	.6000	3.7800	4.9500
CO2, %.....	11.75	11.99	11.87	11.51	10.60
O2, %.....	1.15	.65	.65	.80	.55
HC, ppmC.....	960	1247	1105	1942	2506
NOx, ppm.....	152	77	100	690	185
Air-fuel ratio.....	15.64	15.05	14.99	13.57	12.82
Emission rates, g/hr:					
CO.....	131.2	257.8	272.0	7868.5	8357.7
HC.....	32.6	36.0	25.2	203.6	213.1
NOx**.....	18.3	7.9	8.1	255.8	55.6
Oil temperature, F.....	185	182	181	191	198
Oil pressure, psi.....	33	33	32	34	32
Coolant temperature, F.....	175	173	171	183	175
Exhaust temperature, F.....	832	796	736	1105	1003
Exhaust pressure, in H2O....	9.0	6.0	4.0	55.0	30.0
After Catalyst					
Concentrations, dry basis:					
CO, %.....	.0063	.0031	.0505	3.7800	4.9300
CO2, %.....	11.99	12.24	12.37	11.51	11.05
O2, %.....	.92	.18	.10	.72	.45
HC, ppmC.....	56	62	79	1486	2036
NOx, ppm.....	170	65	25	475	187
Air-fuel ratio.....	15.68	15.07	14.97	13.56	12.87
Emission rates, g/hr:					
CO.....	4.3	1.8	22.8	7859.1	8317.4
HC.....	1.9	1.8	1.8	155.6	173.0
NOx**.....	20.4	6.6	2.0	175.9	56.2
Exhaust temperature, F.....	922	884	754	1225	1040
Exhaust pressure, in H2O....	3.0	2.0	1.0	25.0	15.0

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Chev 350-CID,2V
Fuel..... 7516

Test Number.....	21	22	23	24	25
Test Date.....	5/28/75	5/28/75	5/28/75	5/28/75	5/28/75
Barometer, mm Hg.....	739.5	739.5	739.5	739.5	739.5
Humidity, grains/lb.....	105	105	105	105	105
Temperature, F.....	91	94	93	90	92
Engine speed, rpm.....	1500	1500	1500	1500	1500
Torque, lb-ft.....	182.6	145.0	98.4	59.0	25.6
Power, bhp*.....	53.5	42.6	28.9	17.3	7.5
Fuel rate, lb/hr.....	29.1	22.4	14.8	13.7	9.8
Ignition timing, deg BTC....	12.5	18.0	25.0	27.5	26.5
Manifold vacuum, in Hg.....	5.0	7.0	11.5	14.5	17.5
Throttle angle, deg.....	24.0	18.0	11.0	7.3	4.5
Before Catalyst					
Concentrations, dry basis:					
CO, %.....	5.3400	.2957	.1373	.1395	.3063
CO2, %.....	10.82	13.01	12.88	12.75	13.01
O2, %.....	.73	1.35	1.80	2.35	1.35
HC, ppmC.....	2219	1022	1111	940	1159
NOx, ppm.....	225	870	570	195	100
Air-fuel ratio.....	12.86	15.69	16.10	16.53	15.64
Emission rates, g/hr:					
CO.....	8239.0	425.5	134.0	129.4	192.2
HC.....	172.4	74.1	54.6	43.9	36.6
NOx**.....	56.4	239.4	106.4	34.6	12.0
Oil temperature, F.....	196	195	193	170	185
Oil pressure, psi.....	31	31	31	34	34
Coolant temperature, F.....	176	182	177	181	180
Exhaust temperature, F.....	1041	1064	924	692	830
Exhaust pressure, in H2O....	40.0	29.0	15.0	9.8	7.0
After Catalyst					
Concentrations, dry basis:					
CO, %.....	5.1500	.0018	.0066	.0134	.0134
CO2, %.....	10.94	13.28	13.01	12.75	13.15
O2, %.....	.70	1.05	1.60	2.12	1.15
HC, ppmC.....	1899	68	91	68	97
NOx, ppm.....	155	920	550	220	107
Air-fuel ratio.....	12.94	15.73	16.14	16.55	15.77
Emission rates, g/hr:					
CO.....	7992.5	2.6	6.5	12.5	8.5
HC.....	148.4	5.0	4.5	3.2	3.1
NOx**.....	46.0	253.7	102.9	39.1	13.0
Exhaust temperature, F.....	1152	1127	1007	944	937
Exhaust pressure, in H2O....	20.0	14.0	7.5	2.9	1.5

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Chev 350-CID,2V
Fuel..... 7516

Test Number.....	26	28	29	30	31
Test Date.....	5/28/75	5/28/75	5/28/75	5/28/75	5/29/75
Barometer, mm Hg.....	739.5	739.5	739.5	739.5	737.5
Humidity, grains/lb.....	105	105	105	105	72
Temperature, F.....	93	92	95	96	89
Engine speed, rpm.....	1500	1900	1900	1900	1900
Torque, lb-ft.....	2.0	222.6	186.6	149.2	99.4
Power, bhp*.....	.6	82.7	69.5	55.6	36.6
Fuel rate, lb/hr.....	7.1	40.3	35.5	27.8	20.2
Ignition timing, deg BTC....	26.0	17.0	21.0	25.0	35.0
Manifold vacuum, in Hg.....	21.0	4.5	5.5	7.5	12.6
Throttle angle, deg.....	2.5	31.0	23.5	18.1	12.5
Before Catalyst					
Concentrations, dry basis:					
CO, %.....	.6600	5.0600	1.7300	.3800	.2063
CO2, %.....	12.88	11.05	13.28	13.28	12.75
O2, %.....	.60	.25	.27	1.10	1.35
HC, ppmC.....	1251	1900	1540	901	1074
NOx, ppm.....	115	450	1075	1325	950
Air-fuel ratio.....	14.90	12.73	14.22	15.48	15.75
Emission rates, g/hr:					
CO.....	286.6	10699.4	3558.8	668.1	269.5
HC.....	27.4	202.3	159.5	79.8	70.6
NOx**.....	9.6	182.0	423.0	445.6	200.9
Oil temperature, F.....	184	210	208	205	200
Oil pressure, psi.....	32	33	33	34	34
Coolant temperature, F.....	175	180	181	175	180
Exhaust temperature, F.....	758	1192	1168	1134	1053
Exhaust pressure, in H2O....	2.0	86.0	57.0	42.0	26.0
After Catalyst					
Concentrations, dry basis:					
CO, %.....	.3600	4.9000	1.7300	.0018	.0067
CO2, %.....	13.28	11.05	13.28	13.55	13.28
O2, %.....	.11	.19	.15	.80	1.20
HC, ppmC.....	228	1715	920	25	68
NOx, ppm.....	50	350	920	1425	990
Air-fuel ratio.....	14.81	12.75	14.19	15.55	15.84
Emission rates, g/hr:					
CO.....	155.1	10389.3	3553.1	3.2	8.8
HC.....	5.0	183.1	95.1	2.2	4.5
NOx**.....	4.1	141.9	361.4	481.4	209.7
Exhaust temperature, F.....	787	1273	1264	1184	1095
Exhaust pressure, in H2O....	1.0	48.0	31.0	23.0	13.0

*Corrected - SAE J816b
** Corrected for humidity.

Engine..... Chev 350-CID,2V
Fuel..... 7516

Test Number.....	32	33	34	36	37
Test Date.....	5/29/75	5/29/75	5/29/75	5/29/75	5/29/75
Barometer, mm Hg.....	737.5	737.5	737.5	737.5	737.5
Humidity, grains/lb.....	72	72	72	72	72
Temperature, F.....	90	90	91	86	92
Engine speed, rpm.....	1900	1900	1900	2200	2200
Torque, lb-ft.....	63.8	25.4	2.6	218.8	181.4
Power, bhp*.....	23.5	9.4	1.0	93.1	77.6
Fuel rate, lb/hr.....	16.8	12.8	10.0	49.9	37.7
Ignition timing, deg BTC....	32.0	31.0	32.5	18.5	24.0
Manifold vacuum, in Hg.....	15.0	17.5	20.0	2.5	6.0
Throttle angle, deg.....	9.0	6.9	4.5	30.0	23.0
Before Catalyst					
Concentrations, dry basis:					
CO, %.....	.2302	.1805	.3816	5.2100	1.4200
CO2, %.....	13.55	13.42	13.55	11.51	13.28
O2, %.....	1.75	1.53	.85	.60	.49
HC, ppmC.....	759	666	1153	1769	1490
NOx, ppm.....	465	170	90	380	1275
Air-fuel ratio.....	15.99	15.87	15.22	12.95	14.50
Emission rates, g/hr:					
CO.....	251.8	149.6	237.0	13798.7	3165.7
HC.....	41.8	27.8	36.1	235.9	167.3
NOx**.....	82.3	22.8	9.0	162.9	460.2
Oil temperature, F.....	196	194	190	200	215
Oil pressure, psi.....	34	34	35	35	34
Coolant temperature, F.....	179	175	180	180	180
Exhaust temperature, F.....	959	916	863	1165	1205
Exhaust pressure, in H20....	16.0	11.0	7.0	76.0	64.0
After Catalyst					
Concentrations, dry basis:					
CO, %.....	.0027	.0072	.0027	4.9500	1.3900
CO2, %.....	13.69	13.55	13.97	11.63	13.42
O2, %.....	1.42	1.40	.55	.52	.35
HC, ppmC.....	57	46	63	1606	683
NOx, ppm.....	490	175	97	280	1085
Air-fuel ratio.....	15.95	15.94	15.31	13.02	14.50
Emission rates, g/hr:					
CO.....	2.9	6.0	1.7	13170.2	3094.9
HC.....	3.1	1.9	2.0	215.2	76.6
NOx**.....	86.6	23.6	9.8	120.6	391.1
Exhaust temperature, F.....	1041	1006	966	1279	1287
Exhaust pressure, in H20....	7.0	5.0	3.0	53.0	39.0

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Chev 350-CID,2V
Fuel..... 7516

Test Number.....	38	39	40	41	42
Test Date.....	5/29/75	5/29/75	5/29/75	5/30/75	5/30/75
Barometer, mm Hg.....	737.5	737.5	737.5	736.0	736.0
Humidity, grains/lb.....	72	72	72	67	67
Temperature, F.....	95	93	92	92	99
Engine speed, rpm.....	2200	2200	2200	2200	2200
Torque, lb-ft.....	146.4	98.8	62.6	24.0	.2
Power, bhp*.....	62.8	42.3	26.8	10.3	.1
Fuel rate, lb/hr.....	33.8	22.4	20.6	13.7	11.7
Ignition timing, deg BTC....	28.5	35.0	35.5	35.5	35.5
Manifold vacuum, in Hg.....	8.0	12.7	15.5	18.5	20.0
Throttle angle, deg.....	21.0	15.0	11.0	11.5	8.0
Before Catalyst					
Concentrations, dry basis:					
CO, %.....	.4300	.4200	.2375	.1736	.2648
CO2, %.....	13.55	13.01	13.69	12.49	12.75
O2, %.....	1.15	1.43	1.22	1.85	1.35
HC, ppmC.....	928	986	371	540	912
NOx, ppm.....	1575	1160	570	210	98
Air-fuel ratio.....	15.47	15.69	15.65	16.21	15.70
Emission rates, g/hr:					
CO.....	916.7	604.0	311.8	158.4	199.7
HC.....	99.6	71.4	24.5	24.8	34.6
NOx**.....	543.6	270.1	121.1	30.3	11.7
Oil temperature, F.....	211	208	204	199	190
Oil pressure, psi.....	34	35	35	35	36
Coolant temperature, F.....	180	180	178	177	180
Exhaust temperature, F.....	1195	1101	1015	944	858
Exhaust pressure, in H2O....	49.5	29.0	19.0	11.0	6.0
After Catalyst					
Concentrations, dry basis:					
CO, %.....	.0045	.0022	.0036	.0076	.0045
CO2, %.....	13.97	13.42	13.83	12.79	13.01
O2, %.....	.77	.67	.85	1.65	1.10
HC, ppmC.....	211	246	37	36	57
NOx, ppm.....	1525	1150	590	215	105
Air-fuel ratio.....	15.48	15.43	15.55	16.19	15.75
Emission rates, g/hr:					
CO.....	9.6	3.1	4.7	6.9	3.4
HC.....	22.6	17.5	2.4	1.7	2.2
NOx**.....	526.1	263.2	124.6	31.0	12.6
Exhaust temperature, F.....	1225	1133	1098	1053	1002
Exhaust pressure, in H2O....	31.0	18.0	11.0	7.0	3.0

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Chev 350-CID,2V
Fuel..... 7516

Test Number.....	43	44	45	46	47
Test Date.....	5/30/75	5/30/75	5/30/75	5/30/75	5/30/75
Barometer, mm Hg.....	736.0	736.0	736.0	736.0	736.0
Humidity, grains/lb.....	67	67	67	67	67
Temperature, F.....	87	92	98	98	85
Engine speed, rpm.....	2800	2800	2800	2800	2800
Torque, lb-ft.....	241.6	216.8	181.6	144.0	100.2
Power, bhp*.....	131.1	118.2	99.6	78.9	54.3
Fuel rate, lb/hr.....	67.0	58.5	47.9	41.6	28.5
Ignition timing, deg BTC....	21.0	22.0	27.0	32.5	37.5
Manifold vacuum, in Hg.....	.5	2.5	5.0	7.5	12.5
Throttle angle, deg.....	75.0	34.0	32.5	27.5	18.0
Before Catalyst					
Concentrations, dry basis:					
CO, %.....	2.5500	4.2200	1.1000	.2182	.2500
CO2, %.....	12.24	11.51	12.75	12.75	12.75
O2, %.....	.25	.27	.44	1.25	1.50
HC, ppmC.....	1226	1450	672	364	365
NOx, ppm.....	1490	570	1515	1750	1300
Air-fuel ratio.....	13.85	13.12	14.69	15.78	15.93
Emission rates, g/hr:					
CO.....	9701.9	13320.4	3175.0	588.1	465.8
HC.....	235.1	230.5	97.7	49.5	34.2
NOx**.....	897.4	284.8	692.2	746.7	383.4
Oil temperature, F.....	221	225	225	222	210
Oil pressure, psi.....	35	35	35	35	36
Coolant temperature, F.....	180	180	180	180	180
Exhaust temperature, F.....	1381	1302	1376	1266	1175
Exhaust pressure, in H2O....	188.5	144.0	120.0	84.0	50.0
After Catalyst					
Concentrations, dry basis:					
CO, %.....	2.5000	4.1800	.8300	.0018	.0040
CO2, %.....	12.37	11.51	13.01	13.01	13.01
O2, %.....	.20	.22	.18	1.10	1.03
HC, ppmC.....	638	1007	73	24	13
NOx, ppm.....	1175	470	950	1775	1320
Air-fuel ratio.....	13.89	13.14	14.68	15.82	15.75
Emission rates, g/hr:					
CO.....	9529.1	13212.3	2392.4	4.9	7.4
HC.....	122.6	160.3	10.6	3.2	1.2
NOx**.....	709.0	235.2	433.5	758.2	384.7
Exhaust temperature, F.....	1464	1395	1438	1339	1265
Exhaust pressure, in H2O....	105.0	90.0	76.0	55.0	32.0

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Chev 350-CID,2V
Fuel..... 7516

Test Number.....	49	50	52	53	54
Test Date.....	5/30/75	5/30/75	5/30/75	5/30/75	5/30/75
Barometer, mm Hg.....	736.0	736.0	736.0	736.0	736.0
Humidity, grains/lb.....	67	67	67	67	67
Temperature, F.....	92	97	79	82	84
Engine speed, rpm.....	2800	2800	3300	3300	3300
Torque, lb-ft.....	26.2	1.0	195.0	161.0	128.4
Power, bhp*.....	14.3	.5	123.8	102.5	81.9
Fuel rate, lb/hr.....	22.4	18.4	72.5	56.0	48.0
Ignition timing, deg BTC....	37.5	38.0	27.0	30.0	33.5
Manifold vacuum, in Hg.....	18.0	20.0	4.0	5.5	7.5
Throttle angle, deg.....	11.0	8.0	36.5	32.0	28.5
Before Catalyst					
Concentrations, dry basis:					
CO, %.....	.1328	.1599	4.3200	.5000	.0820
CO2, %.....	12.75	12.62	12.24	12.62	12.24
O2, %.....	1.77	2.00	.05	.68	1.70
HC, ppmC.....	183	194	1979	279	85
NOx, ppm.....	295	155	670	1490	1375
Air-fuel ratio.....	16.19	16.36	13.00	15.21	16.28
Emission rates, g/hr:					
CO.....	197.6	197.5	16638.9	1751.0	264.0
HC.....	13.7	12.1	383.9	49.3	13.7
NOx**.....	69.5	30.3	408.5	826.0	700.9
Oil temperature, F.....	208	204	215	228	226
Oil pressure, psi.....	36	37	36	35	36
Coolant temperature, F.....	179	176	175	175	173
Exhaust temperature, F.....	1080	1017	1275	1437	1329
Exhaust pressure, in H20....	21.0	15.0	174.5	151.0	129.0
After Catalyst					
Concentrations, dry basis:					
CO, %.....	.0018	.0018	4.2800	.0045	.0031
CO2, %.....	12.75	12.75	12.24	13.01	12.24
O2, %.....	1.72	1.87	.03	.35	1.55
HC, ppmC.....	6	9	866	3	9
NOx, ppm.....	310	160	575	1175	1425
Air-fuel ratio.....	16.26	16.37	13.09	15.23	16.22
Emission rates, g/hr:					
CO.....	2.7	2.2	16588.6	15.8	10.0
HC.....	.4	.6	169.1	.6	1.5
NOx**.....	73.3	31.3	352.8	652.1	724.3
Exhaust temperature, F.....	1198	1175	1423	1496	1412
Exhaust pressure, in H20....	12.0	9.0	105.3	97.0	77.0

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Chev 350-CID,2V
Fuel..... 7516

Test Number.....	55	56	57	58	59
Test Date.....	5/30/75	5/30/75	5/30/75	5/30/75	5/30/75
Barometer, mm Hg.....	736.0	736.0	736.0	736.0	736.0
Humidity, grains/lb.....	67	67	67	67	67
Temperature, F.....	87	88	90	93	83
Engine speed, rpm.....	3300	3300	3300	3300	3800
Torque, lb-ft.....	83.8	55.4	20.0	.2	200.0
Power, bhp*.....	53.6	35.5	12.8	.1	146.8
Fuel rate, lb/hr.....	37.2	32.0	19.7	18.3	82.5
Ignition timing, deg BTC....	40.0	41.0	40.0	40.0	25.0
Manifold vacuum, in Hg.....	13.0	15.5	17.0	20.0	2.5
Throttle angle, deg.....	21.0	17.5	13.5	11.0	74.0
Before Catalyst					
Concentrations, dry basis:					
CO, %.....	.2063	.2399	.2424	.1373	1.7300
CO2, %.....	12.37	12.49	12.37	12.24	11.99
O2, %.....	1.20	1.08	1.20	1.53	.25
HC, ppmC.....	218	194	134	97	1364
NOx, ppm.....	1110	720	330	200	1625
Air-fuel ratio.....	15.77	15.63	15.73	16.06	14.17
Emission rates, g/hr:					
CO.....	498.7	494.2	309.5	166.4	8344.7
HC.....	26.6	20.1	8.6	5.9	331.2
NOx**.....	424.7	234.8	66.7	38.4	1240.8
Oil temperature, F.....	222	219	215	212	210
Oil pressure, psi.....	36	36	36	38	40
Coolant temperature, F.....	174	174	174	172	175
Exhaust temperature, F.....	1203	1151	1099	1031	1155
Exhaust pressure, in H2O....	60.0	44.0	28.0	20.0	180.1
After Catalyst					
Concentrations, dry basis:					
CO, %.....	.0022	.0018	.0027	.0063	1.7300
CO2, %.....	12.62	12.75	12.62	12.24	12.24
O2, %.....	1.05	1.00	1.12	1.52	.05
HC, ppmC.....	11	6	6	3	398
NOx, ppm.....	1135	750	350	210	1500
Air-fuel ratio.....	15.78	15.71	15.81	16.15	14.14
Emission rates, g/hr:					
CO.....	5.3	3.7	3.5	7.7	8307.6
HC.....	1.4	.6	.4	.2	96.2
NOx**.....	434.2	245.6	71.0	40.5	1140.2
Exhaust temperature, F.....	1298	1283	1243	1212	1331
Exhaust pressure, in H2O....	39.0	28.0	17.0	12.0	138.5

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Chev 350-CID,2V
Fuel..... 7516

Test Number.....	60	61	62	63	64
Test Date.....	5/30/75	5/31/75	5/31/75	5/31/75	5/31/75
Barometer, mm Hg.....	736.0	742.1	742.1	742.1	742.1
Humidity, grains/lb.....	67	59	59	59	59
Temperature, F.....	82	83	81	84	85
Engine speed, rpm.....	3800	3800	3800	3800	3800
Torque, lb-ft.....	180.4	149.8	119.6	81.4	50.8
Power, bhp*.....	132.3	108.9	86.7	59.2	37.0
Fuel rate, lb/hr.....	75.1	67.9	54.5	41.0	31.5
Ignition timing, deg BTC....	28.0	32.5	37.5	41.5	42.5
Manifold vacuum, in Hg.....	4.5	6.0	7.5	13.8	16.0
Throttle angle, deg.....	40.5	33.0	29.5	21.9	18.2
Before Catalyst					
Concentrations, dry basis:					
CO, %.....	3.4900	.3512	1.6500	.1829	.1969
CO2, %.....	11.16	12.12	11.75	11.75	11.75
O2, %.....	.24	.67	1.60	1.35	1.35
HC, ppmC.....	1652	204	74	170	114
NOx, ppm.....	940	1885	1675	1375	850
Air-fuel ratio.....	13.32	15.30	15.32	15.97	15.95
Emission rates, g/hr:					
CO.....	14439.9	1509.4	5664.4	496.0	409.6
HC.....	344.2	44.2	12.8	23.2	11.9
NOx**.....	615.7	1240.2	880.3	570.8	270.7
Oil temperature, F.....	239	239	225	230	228
Oil pressure, psi.....	35	35	36	37	38
Coolant temperature, F.....	180	176	180	180	178
Exhaust temperature, F.....	1389	1429	1278	1216	1179
Exhaust pressure, in H20....	210.5	174.5	128.0	60.0	49.0
After Catalyst					
Concentrations, dry basis:					
CO, %.....	3.4500	.0031	.0049	.0031	.0031
CO2, %.....	11.16	12.24	11.75	11.99	11.99
O2, %.....	.20	.68	1.50	1.32	1.22
HC, ppmC.....	665	11	9	11	6
NOx, ppm.....	780	1875	1775	1495	930
Air-fuel ratio.....	13.39	15.53	16.25	16.06	15.96
Emission rates, g/hr:					
CO.....	14349.9	13.5	18.0	8.4	6.4
HC.....	139.3	2.5	1.7	1.5	.6
NOx**.....	513.6	1252.1	995.7	623.4	296.1
Exhaust temperature, F.....	1477	1509	1407	1327	1309
Exhaust pressure, in H20....	138.5	110.8	83.0	38.0	30.0

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Chev 350-CID,2V
Fuel..... 7516

Test Number.....	65	66	67	68	69
Test Date.....	5/31/75	5/31/75	5/31/75	5/31/75	5/31/75
Barometer, mm Hg.....	742.1	742.1	742.1	742.1	742.1
Humidity, grains/lb.....	59	59	59	59	59
Temperature, F.....	88	92	82	84	89
Engine speed, rpm.....	3800	3800	3300	3300	3300
Torque, lb-ft.....	21.2	5.0	224.8	170.2	56.4
Power, bhp*.....	15.5	3.7	141.7	107.5	35.8
Fuel rate, lb/hr.....	27.4	22.6	76.0	58.5	31.0
Ignition timing, deg BTC....	42.0	42.0	23.5	31.5	40.5
Manifold vacuum, in Hg.....	18.0	19.5	2.0	5.5	16.0
Throttle angle, deg.....	14.9	13.0	75.0	32.5	17.0
Before Catalyst					
Concentrations, dry basis:					
CO, %.....	.2800	.2700	1.7200	.5400	.2800
CO2, %.....	11.99	12.37	11.75	11.99	11.99
O2, %.....	1.40	1.37	.33	.60	1.20
HC, ppmC.....	103	92	3419	114	215
NOx, ppm.....	430	305	1775	1750	685
Air-fuel ratio.....	15.90	15.85	14.00	15.16	15.73
Emission rates, g/hr:					
CO.....	503.9	398.2	7578.6	1979.5	564.6
HC.....	9.3	6.8	758.0	21.1	21.9
NOx**.....	118.5	68.9	1197.2	982.1	211.4
Oil temperature, F.....	225	210	236	230	220
Oil pressure, psi.....	38	40	34	35	35
Coolant temperature, F.....	179	178	178	176	175
Exhaust temperature, F.....	1142	1001	1456	1415	1217
Exhaust pressure, in H20....	33.0	25.0	238.2	152.5	41.0
After Catalyst					
Concentrations, dry basis:					
CO, %.....	.0018	.0022	1.6800	.0089	.0018
CO2, %.....	12.24	12.49	11.99	12.37	12.12
O2, %.....	1.20	1.32	.19	.40	1.00
HC, ppmC.....	9	9	400	10	12
NOx, ppm.....	455	310	1750	1525	709
Air-fuel ratio.....	15.90	15.97	14.24	15.30	15.76
Emission rates, g/hr:					
CO.....	3.2	3.3	7506.4	32.9	3.6
HC.....	.8	.7	89.9	1.9	1.3
NOx**.....	125.3	70.5	1197.0	862.7	219.3
Exhaust temperature, F.....	1272	1232	1540	1471	1271
Exhaust pressure, in H20....	20.0	14.0	159.3	99.0	27.0

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Chev 350-CID,2V
Fuel..... 7516

Test Number.....	70	72	73	75	76
Test Date.....	5/31/75	5/31/75	5/31/75	6/ 2/75	6/ 2/75
Barometer, mm Hg.....	742.1	742.1	742.1	747.5	747.5
Humidity, grains/lb.....	59	59	59	94	94
Temperature, F.....	92	81	88	78	88
Engine speed, rpm.....	3300	2800	2800	3800	3800
Torque, lb-ft.....	1.6	174.8	58.6	204.0	154.0
Power, bhp*.....	1.0	93.4	31.5	147.6	112.5
Fuel rate, lb/hr.....	16.8	54.5	25.9	82.7	69.1
Ignition timing, deg BTC....	40.0	28.0	37.0	25.0	33.0
Manifold vacuum, in Hg.....	20.0	5.0	15.0	2.5	5.5
Throttle angle, deg.....	11.0	33.5	16.9	75.0	34.5
Before Catalyst					
Concentrations, dry basis:					
CO, %.....	.1284	1.0600	.4800	1.4500	.5800
CO2, %.....	11.75	11.87	11.99	13.15	13.28
O2, %.....	1.48	.50	1.17	.48	.94
HC, ppmC.....	114	660	457	1282	453
NOx, ppm.....	200	1662	850	1875	1735
Air-fuel ratio.....	16.07	14.74	15.57	14.52	15.33
Emission rates, g/hr:					
CO.....	143.6	3522.8	799.5	7100.1	2508.3
HC.....	6.4	110.4	38.4	316.4	98.6
NOx**.....	34.2	845.5	216.7	1655.0	1352.4
Oil temperature, F.....	210	210	215	217	237
Oil pressure, psi.....	37	35	35	36	35
Coolant temperature, F.....	175	179	179	176	175
Exhaust temperature, F.....	1059	1226	1168	1447	1454
Exhaust pressure, in H20....	20.0	112.0	35.0	249.5	177.3
After Catalyst					
Concentrations, dry basis:					
CO, %.....	.0018	.9100	.0045	1.4200	.0500
CO2, %.....	11.75	11.99	12.24	13.28	13.83
O2, %.....	1.45	.28	.80	.30	.66
HC, ppmC.....	11	144	20	292	11
NOx, ppm.....	207	1425	805	1525	1100
Air-fuel ratio.....	16.14	14.71	15.60	14.50	15.41
Emission rates, g/hr:					
CO.....	2.0	3016.2	7.5	6938.5	216.9
HC.....	.6	24.0	1.7	71.9	2.5
NOx**.....	35.6	723.0	205.7	1343.2	860.2
Exhaust temperature, F.....	1198	1341	1211	1569	1508
Exhaust pressure, in H20....	11.0	78.0	22.0	159.4	110.8

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Chev 350-CID,2V
Fuel..... 7516

Test Number.....	77	78	79	80	81
Test Date.....	6/ 2/75	6/ 2/75	6/ 2/75	6/ 2/75	6/ 2/75
Barometer, mm Hg.....	747.5	747.5	747.5	747.5	747.5
Humidity, grains/lb.....	94	94	94	94	66
Temperature, F.....	89	89	81	87	97
Engine speed, rpm.....	3800	3800	1900	1900	1900
Torque, lb-ft.....	58.0	5.0	262.0	192.0	60.0
Power, bhp*.....	42.4	3.7	95.1	70.1	22.0
Fuel rate, lb/hr.....	32.1	20.9	48.1	35.6	14.8
Ignition timing, deg BTC....	43.5	42.5	17.0	23.0	32.0
Manifold vacuum, in Hg.....	15.0	19.5	.4	6.0	16.0
Throttle angle, deg.....	20.5	14.0	75.0	24.0	10.0
Before Catalyst					
Concentrations, dry basis:					
CO, %.....	.3500	.3063	3.4900	1.0000	.2400
CO2, %.....	13.15	13.28	12.12	13.28	12.75
O2, %.....	.85	.98	.95	.37	1.90
HC, ppmC.....	254	145	1563	1012	628
NOx, ppm.....	870	255	1000	1325	340
Air-fuel ratio.....	15.38	15.48	13.87	14.66	16.17
Emission rates, g/hr:					
CO.....	707.1	405.1	9520.3	2131.3	235.5
HC.....	25.9	9.7	214.7	108.6	31.0
NOx**.....	316.8	60.8	491.7	509.0	52.6
Oil temperature, F.....	230	223	214	207	195
Oil pressure, psi.....	36	38	31	31	32
Coolant temperature, F.....	175	175	175	175	175
Exhaust temperature, F.....	1253	1116	1155	1117	892
Exhaust pressure, in H20....	57.0	25.0	59.0	43.0	13.0
After Catalyst					
Concentrations, dry basis:					
CO, %.....	.0045	.0031	3.3700	.8700	.0063
CO2, %.....	13.42	13.28	12.24	13.42	13.01
O2, %.....	.55	.85	.89	.11	1.70
HC, ppmC.....	11	11	1144	233	47
NOx, ppm.....	900	255	950	1200	340
Air-fuel ratio.....	15.36	15.56	13.93	14.61	16.21
Emission rates, g/hr:					
CO.....	9.1	4.1	9221.3	1848.5	6.2
HC.....	1.2	.8	157.7	24.9	2.3
NOx**.....	327.3	61.2	468.5	459.6	52.6
Exhaust temperature, F.....	1320	1259	1284	1224	1010
Exhaust pressure, in H20....	38.0	15.0	41.0	26.0	7.0

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Chev 350-CID,2V
Fuel..... 7516

Test Number.....	82	83	84	85	86
Test Date.....	6/ 2/75	6/ 2/75	6/ 2/75	6/ 2/75	6/ 2/75
Barometer, mm Hg.....	747.5	747.5	747.5	747.5	747.5
Humidity, grains/lb.....	66	66	66	66	66
Temperature, F.....	112	81	88	97	102
Engine speed, rpm.....	1900	1500	1500	1500	1500
Torque, lb-ft.....	3.0	250.0	185.0	70.0	3.0
Power, bhp*.....	1.1	71.2	53.0	20.2	.9
Fuel rate, lb/hr.....	10.5	37.8	25.5	12.6	8.8
Ignition timing, deg BTC....	33.5	10.5	16.0	26.5	26.0
Manifold vacuum, in Hg.....	20.0	.5	5.5	13.5	19.5
Throttle angle, deg.....	6.0	75.0	20.5	9.5	4.0
Before Catalyst					
Concentrations, dry basis:					
CO, %.....	.3063	3.5500	2.9800	.1152	.6800
CO2, %.....	12.75	11.99	12.24	12.24	12.75
O2, %.....	1.75	.42	.55	2.95	1.85
HC, ppmC.....	1385	1400	1481	665	1850
NOx, ppm.....	73	850	500	225	54
Air-fuel ratio.....	15.92	13.52	13.82	17.12	15.72
Emission rates, g/hr:					
CO.....	210.0	7431.7	4300.9	102.1	385.3
HC.....	47.8	147.7	107.6	29.7	52.8
NOx**.....	7.8	280.4	113.7	31.4	4.8
Oil temperature, F.....	190	200	197	185	183
Oil pressure, psi.....	34	30	31	31	31
Coolant temperature, F.....	175	180	172	175	175
Exhaust temperature, F.....	803	1077	1011	844	739
Exhaust pressure, in H20....	7.0	46.0	28.0	11.0	5.0
After Catalyst					
Concentrations, dry basis:					
CO, %.....	.0045	3.4000	2.8800	.0031	.0022
CO2, %.....	13.15	12.12	12.49	12.49	13.28
O2, %.....	1.25	.33	.33	2.80	1.13
HC, ppmC.....	92	1050	1074	52	128
NOx, ppm.....	83	740	490	230	60
Air-fuel ratio.....	15.85	13.56	13.77	17.12	15.75
Emission rates, g/hr:					
CO.....	3.1	7133.2	4136.3	2.7	1.2
HC.....	3.2	111.0	77.7	2.3	3.6
NOx**.....	8.9	244.6	110.9	32.1	5.4
Exhaust temperature, F.....	924	1224	1131	942	850
Exhaust pressure, in H20....	3.0	26.0	16.0	6.0	2.0

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Chev 350-CID,2V
Fuel..... 7516

Test Number.....	87	88	89	90	91
Test Date.....	6/ 3/75	6/ 3/75	6/ 3/75	6/ 3/75	6/ 3/75
Barometer, mm Hg.....	741.0	741.0	741.0	741.0	741.0
Humidity, grains/lb.....	64	64	64	64	64
Temperature, F.....	86	83	90	99	85
Engine speed, rpm.....	2500	2500	2500	2500	2200
Torque, lb-ft.....	256.0	193.0	64.0	3.0	259.0
Power, bhp*.....	123.0	92.5	30.9	1.5	109.4
Fuel rate, lb/hr.....	58.2	43.4	20.3	13.1	54.4
Ignition timing, deg BTC....	19.5	27.5	37.0	37.0	18.0
Manifold vacuum, in Hg.....	.5	5.0	15.5	20.0	.5
Throttle angle, deg.....	75.0	28.5	13.0	8.5	75.0
Before Catalyst					
Concentrations, dry basis:					
CO, %.....	4.2900	.9700	.1736	.1736	3.4900
CO2, %.....	11.75	13.01	12.75	12.24	11.75
O2, %.....	.50	.38	1.43	2.20	.30
HC, ppmC.....	1320	799	442	677	1304
NOx, ppm.....	940	1635	585	115	1050
Air-fuel ratio.....	13.29	14.70	15.89	16.49	13.46
Emission rates, g/hr:					
CO.....	13594.9	2534.9	229.9	154.3	10501.9
HC.....	210.7	105.2	29.4	30.3	197.5
NOx**.....	465.5	667.7	121.1	16.0	493.8
Oil temperature, F.....	193	217	208	200	215
Oil pressure, psi.....	35	34	34	35	32
Coolant temperature, F.....	176	175	174	175	172
Exhaust temperature, F.....	1181	1229	1020	889	1200
Exhaust pressure, in H2O....	121.0	82.0	21.0	10.0	102.0
After Catalyst					
Concentrations, dry basis:					
CO, %.....	3.8100	.8100	.0036	.0036	3.2600
CO2, %.....	11.75	12.75	12.75	12.37	11.63
O2, %.....	.47	.12	1.35	2.15	.20
HC, ppmC.....	894	80	23	34	1072
NOx, ppm.....	940	1275	580	123	795
Air-fuel ratio.....	13.48	14.65	15.98	16.63	13.48
Emission rates, g/hr:					
CO.....	12263.5	2117.0	4.8	3.2	9847.4
HC.....	144.9	10.5	1.5	1.5	163.1
NOx**.....	472.8	520.8	120.8	17.2	375.3
Exhaust temperature, F.....	1334	1331	1113	1037	1322
Exhaust pressure, in H2O....	78.0	53.0	13.0	7.0	65.0

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Chev 350-CID,2V
Fuel..... 7516

Test Number.....	92	93	94	95	96
Test Date.....	6/ 3/75	6/ 3/75	6/ 3/75	6/ 3/75	6/ 3/75
Barometer, mm Hg.....	741.0	741.0	741.0	741.0	741.0
Humidity, grains/lb.....	64	64	64	64	64
Temperature, F.....	89	94	99	82	90
Engine speed, rpm.....	2200	2200	2200	1300	1300
Torque, lb-ft.....	195.0	64.0	3.0	232.0	174.0
Power, bhp*.....	82.7	27.3	1.3	57.8	43.6
Fuel rate, lb/hr.....	41.5	18.1	10.9	31.0	22.9
Ignition timing, deg BTC....	23.0	35.5	35.5	10.5	11.0
Manifold vacuum, in Hg.....	5.5	16.0	20.0	.2	5.5
Throttle angle, deg.....	28.0	11.0	7.0	75.0	18.5
Before Catalyst					
Concentrations, dry basis:					
CO, %.....	1.5800	.2206	.1969	2.8200	3.8400
CO2, %.....	12.37	12.49	11.99	11.51	11.05
O2, %.....	.40	1.45	2.00	.35	.35
HC, ppmC.....	1138	588	1350	1456	1707
NOx, ppm.....	1275	440	75	800	200
Air-fuel ratio.....	14.37	15.87	16.25	13.70	13.22
Emission rates, g/hr:					
CO.....	3874.2	260.7	144.0	4946.8	4807.1
HC.....	140.5	35.0	49.7	128.6	107.6
NOx**.....	488.6	81.3	8.6	219.3	39.1
Oil temperature, F.....	215	208	195	185	195
Oil pressure, psi.....	32	33	34	30	30
Coolant temperature, F.....	175	175	175	175	168
Exhaust temperature, F.....	1144	1035	842	968	996
Exhaust pressure, in H2O....	60.0	16.0	8.0	32.0	21.0
After Catalyst					
Concentrations, dry basis:					
CO, %.....	1.5500	.0045	.0018	3.1200	4.7800
CO2, %.....	12.37	12.49	12.12	11.39	10.71
O2, %.....	.25	1.27	1.70	.05	.03
HC, ppmC.....	865	106	79	819	1527
NOx, ppm.....	1185	435	95	750	160
Air-fuel ratio.....	14.31	15.92	16.29	13.43	12.65
Emission rates, g/hr:					
CO.....	3784.9	5.3	1.3	5368.3	5738.2
HC.....	106.4	6.4	2.9	71.0	92.3
NOx**.....	452.2	80.7	10.9	201.7	30.0
Exhaust temperature, F.....	1264	1076	964	1149	1058
Exhaust pressure, in H2O....	38.0	9.0	4.0	18.0	12.0

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Chev 350-CID, 2V
Fuel..... 7516

Test Number.....	97	98	99	100	101
Test Date.....	6/ 3/75	6/ 3/75	6/10/75	6/ 3/75	6/ 3/75
Barometer, mm Hg.....	741.0	741.0	742.5	741.0	741.0
Humidity, grains/lb.....	64	64	59	64	64
Temperature, F.....	98	107	80	92	101
Engine speed, rpm.....	1300	1300	1000	1000	1000
Torque, lb-ft.....	58.0	3.0	220.0	168.0	55.0
Power, bhp*.....	14.7	.8	41.9	32.5	10.7
Fuel rate, lb/hr.....	9.4	5.4	23.0	18.3	8.6
Ignition timing, deg BTC....	23.0	24.5	3.5	8.5	21.5
Manifold vacuum, in Hg.....	13.5	21.5	.5	5.0	13.0
Throttle angle, deg.....	8.0	3.0	75.0	14.0	5.0
Before Catalyst					
Concentrations, dry basis:					
CO, %.....	.1373	.6300	2.8800	3.7200	.6800
CO2, %.....	11.87	12.24	11.87	11.28	11.87
O2, %.....	2.35	1.66	.17	.50	1.90
HC, ppmC.....	898	1131	1767	1903	1690
NOx, ppm.....	135	82	900	345	84
Air-fuel ratio.....	16.65	15.73	13.57	13.37	15.84
Emission rates, g/hr:					
CO.....	88.7	220.2	3700.0	3756.3	382.2
HC.....	29.2	19.9	114.3	96.8	47.9
NOx**.....	13.6	4.5	177.0	54.4	7.4
Oil temperature, F.....	185	174	185	182	180
Oil pressure, psi.....	30	32	29	29	29
Coolant temperature, F.....	175	175	175	165	175
Exhaust temperature, F.....	836	614	934	887	783
Exhaust pressure, in H20....	9.0	3.0	25.0	14.0	5.0
After Catalyst					
Concentrations, dry basis:					
CO, %.....	.0036	.0009	2.6600	3.7200	.0031
CO2, %.....	12.12	12.75	11.99	11.81	12.49
O2, %.....	2.25	.95	.05	.03	1.20
HC, ppmC.....	68	125	1371	1489	136
NOx, ppm.....	140	81	830	305	88
Air-fuel ratio.....	16.74	15.65	13.62	13.17	15.85
Emission rates, g/hr:					
CO.....	2.3	.3	3429.6	3684.8	1.7
HC.....	2.2	2.2	89.0	74.3	3.8
NOx**.....	14.2	4.4	163.8	47.2	7.7
Exhaust temperature, F.....	896	662	1098	945	748
Exhaust pressure, in H20....	4.0	1.0	14.0	8.0	2.0

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Chev 350-CID,2V
Fuel..... 7516

Test Number.....	102	103
Test Date.....	6/ 3/75	6/ 3/75
Barometer, mm Hg.....	741.0	741.0
Humidity, grains/lb.....	64	64
Temperature, F.....	100	92
Engine speed, rpm.....	1000	800
Torque, lb-ft.....	3.0	3.0
Power, bhp*.....	.6	.5
Fuel rate, lb/hr.....	4.0	3.7
Ignition timing, deg BTC....	21.0	20.5
Manifold vacuum, in Hg.....	20.0	19.5
Throttle angle, deg.....	1.5	0.0
Before Catalyst		
Concentrations, dry basis:		
CO, %.....	.4075	.2063
CO2, %.....	11.75	11.28
O2, %.....	2.70	3.60
HC, ppmC.....	1011	3354
NOx, ppm.....	67	44
Air-fuel ratio.....	16.74	17.37
Emission rates, g/hr:		
CO.....	112.6	54.9
HC.....	14.1	44.9
NOx**.....	2.9	1.8
Oil temperature, F.....	174	170
Oil pressure, psi.....	30	28
Coolant temperature, F.....	170	174
Exhaust temperature, F.....	592	472
Exhaust pressure, in H20....	3.0	2.0
After Catalyst		
Concentrations, dry basis:		
CO, %.....	.0031	.0045
CO2, %.....	12.12	11.63
O2, %.....	2.00	2.75
HC, ppmC.....	112	336
NOx, ppm.....	62	45
Air-fuel ratio.....	16.53	17.19
Emission rates, g/hr:		
CO.....	.8	1.2
HC.....	1.5	4.4
NOx**.....	2.6	1.8
Exhaust temperature, F.....	615	512
Exhaust pressure, in H20....	1.0	1.0

* Corrected - SAE J816b
** Corrected for humidity.