PB 286 074

REPORT NOS. DOT-TSC-NHTSA-78-8 HS-803 324

# PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES
## First Series - Report No. 14
## 1975 Mazda Rotary 70 CID (1.1 Liters), 4V

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MAY 1978
INTERIM REPORT



Prepared for

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
Washington DC 20590

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Technical Report Documentation Page

| 1. Report No. | 2. Government Accession No. | 3. Recipient's Catalog No. |
|---|---|---|
| HS-803 324 | | PB 286074 |

4. Title and Subtitle
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES
First Series - Report No. 14
1975 Mazda Rotary 70 CID (1.1 Liters), 4V

5. Report Date
May 1978

6. Performing Organization Code

7. Author(s)
W. F. Marshall and K. R. Stamper

8. Performing Organization Report No.
DOT-TSC-NHTSA-78-8
BERC/OP-76/32

9. Performing Organization Name and Address
U.S. Department of Energy*
Bartlesville Energy Research Center
P.O. Box 1398
Bartlesville OK 74003

10. Work Unit No. (TRAIS)
HS827/R8402

11. Contract or Grant No.
RA-75-10

12. Sponsoring Agency Name and Address
U.S. Department of Transportation
National Highway Traffic Safety Administration
Office of Research and Development
Office of Passenger Vehicle Research
Technology Assessment Division
Washington, DC 20590

13. Type of Report and Period Covered
Interim Report
July 1977

14. Sponsoring Agency Code

15. Supplementary Notes
*Interagency agreement with: U.S. Department of Transportation
Transportation Systems Center
Kendall Square
Cambridge MA 02142

16. Abstract

Experimental data were obtained in dynamometer tests of a 1975 Mazda 70 CID, 4V rotary engine to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, oxides of nitrogen) at steady-state engine-operating modes. The objective of the program is to obtain engine performance data for estimating emissions and fuel economy for varied engine service and duty. The intent of the work is to provide basic engine characteristic data required as input for engineering calculations involving ground transportation.

| 17. Key Words | 18. Distribution Statement |
|---|---|
| Fuel Economy<br>Auto Emissions | DOCUMENT IS AVAILABLE TO THE U.S. PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161 |

| 19. Security Classif. (of this report) | 20. Security Classif. (of this page) | 21. No. of Pages | 22. Price |
|---|---|---|---|
| Unclassified | Unclassified | 40 | A03-A01 |

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

## PREFACE

This report was prepared by the U.S. Department of Energy, Bartlesville Energy Research Center, for the U.S. Department of Transportation, Transportation Systems Center, Energy Technology Branch, Cambridge MA. Presented are results of experimental work to obtain information on the performance characteristics of an engine used in automobiles sold in the United States. The engine used in this work is one of a series of 23 engines to be tested in the current program.

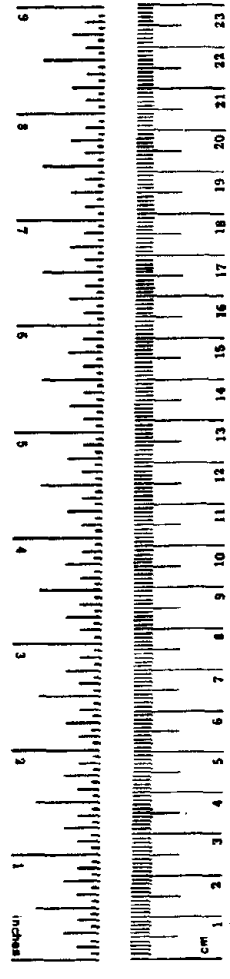
This project is funded by the National Highway Traffic Safety Administration, Office of Research and Development, Office of Passenger Vehicle Research, Technology Assessment Division.

Ralph G. Colello and James A. Kidd, Jr., of the U.S. Department of Transportation, Transportation Systems Center, are the technical monitors.

## METRIC CONVERSION FACTORS

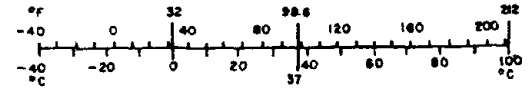
### Approximate Conversions to Metric Measures

| 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

This report presents data acquired from tests of a 1975 Mazda 70 CID, 4V rotary engine. Mazda uses this particular engine in both the model RX-3 sedan and RX-3 wagon. The test results were sufficient to establish steady-state maps for fuel consumption and emission levels (carbon monoxide, hydrocarbon, oxides of nitrogen) over the entire operating range of the engine.

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

## 2. ENGINE TEST REPORT

General engine specifications for the Mazda RX-3 are given in table 1. A single batch of unleaded regular fuel was used throughout engine breakin (table 2) and test; the fuel analysis is given in table 3.

A new mean-tolerance engine was mounted on a test stand and coupled to an eddy-current dynamometer. The engine was not equipped with a fan, and a cooling tower was used in place of a radiator. The alternator was included in the test setup but was not wired into the electrical system. The primary emission control systems included air injection, thermal reactor, and ignition control. The ignition control system functioned to deactivate the trailing ignition system between engine speeds of 1,300 and 4,000 rpm.

The breakin consisted of 40 hours of engine operation at various speeds and loads designed to simulate road conditions. During the steady-state tests the engine was operated at the following modes:

Speeds: 1,000; 1,500; 2,000; 2,500; 3,000; 4,000; 5,000; 6,000 rpm

Loads: 0, 10, 25, 40, 60, 75, 90, 100 pct of full load (0, 25, 40, 60, and 75 pct points were repeated for all engine speeds except 1,500; 2,500, and 6,000 rpm)

Idle speeds: 0, 1, 2 hp (no repeats)

Motored: 1,000; 1,500; and 2,000 rpm (each repeated)

| | |
|---|---|
| Total number of test modes | 76 |
| Repeats | 28 |
| Total number of tests | 104 |

The following data were recorded:

Test number
Date
Barometric pressure, mm Hg
Dewpoint, °F
Inlet air temperature, °F
Speed, rpm
Torque, lb-ft -- BLH strain gage load cell; Daytronics indicator
Fuel rate, lb/hr -- Fluidyne positive displacement fuel flowmeter
Ignition timing, °BTC
Manifold vacuum, in. Hg
Intake manifold temperature, °F

Throttle angle, deg
CO, pct -- Beckman NDIR
$CO_2$, pct -- Beckman NDIR
$O_2$, pct -- Beckman polarographic detector
HC, ppmC -- Custom-built heated flame ionization detector
$NO_x$, ppm -- 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 emission rates of carbon monoxide (CO), unburned hydrocarbons (HC), and oxides of nitrogen ($NO_x$) in grams/hour. The following equations were applied in the computations:

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

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

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

$$A/F = 4.895\left[\frac{(CO) + 2(CO_2) + 2(O_2) + \left(\frac{NO_x}{10^4}\right) + 3.148(CO_2)\left(\frac{CO + CO_2}{CO + 3CO_2}\right)}{(CO) + (CO_2) + \left(\frac{HC}{10^4}\right)\ 1 + 0.03148(CO_2)\left(\frac{CO + CO_2}{CO + 3CO_2}\right)}\right].$$

The equation for A/F is based on:

Fuel = $CH_{2.099}$,

Water-gas-shift equilibrium constant = $\frac{(CO)\ (H_2O)}{(CO_2)\ (H_2)} = 3$,

HC was determined on a raw exhaust, wet basis, all other species measured on a dry basis.

$$\text{Mass CO} = \left(\frac{M_{ex}}{C_w}\right)\left(\frac{CO}{100}\right)\left(\frac{MW_{co}}{MW_{ex}}\right)453.59237,$$

where $MW_{co}$ = molecular weight of CO(=28.01115),

$MW_{ex}$ = molecular weight of exhaust gas (=28.967),

$C_w$ = correction for water removal = $1 + \frac{\left(\frac{x}{2}\right)\left(CO+CO_2\right)-H_2}{100}$.

Mass HC = 0.0002207 (F) (A/F + 1) (HC),

Mass $NO_x$ = $0.0007201\ (F)\ (A/F + 1)\ (NO_x)\left[\frac{1}{1 + 0.03148(CO_2)\left(\frac{CO + CO_2}{CO + 3CO_2}\right)}\right]\left(K_H\right)$,

$K_H$ is the humidity correction factor (dimensionless):

$K_H = \frac{1}{1 - 0.0047\ (H - 75)}$,

where A/F = air-fuel ratio

B = barometric pressure, mm Hg

CO = carbon monoxide concentration, pct, vol

$CO_2$ = carbon dioxide concentration, pct, vol

D = intake air dewpoint, °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

$NO_x$ = nitrogen oxides concentration, ppm, vol

$O_2$ = oxygen concentration, pct, vol

P = corrected power, brake horsepower

t = intake air temperature, °F

T = torque, ft-lb

W = water vapor pressure, mm Hg.

## 3. DISCUSSION OF TEST RESULTS

The engine data (shown plotted in figures 1 through 6) were highly repeatable. The plots of engine performance at wide-open throttle (WOT) show that the peak torque point and minimum brake specific fuel consumption (bsfc) point occur at approximately the same engine speed (figure 1). The bsfc plot shows a slight discontinuity between the 1,500 and 2,000 rpm. This could be attributed to the activation or deactivation of engine control accessories and some inaccuracies in fuel flow measurement. The maximum torque output and maximum brake horsepower exceeded the values quoted in table 1.

The effect of the air-injection system on the calculation of air-fuel ratio can be seen in figure 2; these numbers do not reflect the actual stoichiometry in the combustion chamber. The air is injected into the exhaust gas stream for postcombustion oxidation of unburned hydrocarbon and carbon monoxide (figures 3 and 4). Oxides of nitrogen emissions were controlled through the use of retarded ignition timing (both leading and trailing) and operation at fuel-rich conditions in the combustion chamber (figure 5). The fuel rate was found to be nearly linear with power for each engine speed (figure 6).

## 4. CONCLUSIONS

The steady-state engine test data were sufficiently repeatable for the purposes of these tests.

TABLE 1. MANUFACTURER'S ENGINE SPECIFICATIONS

| | |
|---|---|
| Model number | RX-3 |
| Displacement, cu. in. | 70 |
| Maximum horsepower @ 6,000 rpm | 90 |
| Maximum torque, ft-lb @ 4,000 rpm | 96 |
| Configuration | Two in-line rotors |
| Rotor width, inches | 2.75 |
| Compression ratio | 9.4 |
| Firing order | 1-2 |
| Ignition timing: | |
| Leading @ 500 rpm | 0 |
| Trailing, °ATC | 15 |
| Centrifugal advance: | |
| Leading.....starts, rpm | 500 |
| maximum @ 1,250 rpm | 7.5 |
| Trailing....starts, rpm | 500 |
| maximum @ 1,250 rpm | 7.5 |
| Dwell angle, deg | 58 |
| Point gap, inches | 0.018 |
| Port timing: | |
| Intake opens, °ATC | 32 |
| Intake closes, °ABC | 50 |
| Exhaust opens, °BBC | 71 |
| Exhaust closes, °ATC | 48.5 |
| Fan drive | Hydraulic coupling |
| Carburetor type | 4V, 2-stage, downdraft |
| Engine weight, lb | 335 |
| Air-injection system: | |
| Air delivery point | Thermal reactor |
| Pump drive | Fan belt |

TABLE 2. ENGINE BREAK-IN SCHEDULE

| Simulated Vehicle Speed, mph | Engine Speed, rpm | Intake Manifold Vacuum, in. Hg | Fraction of Time in Mode |
|---|---|---|---|
| 0 | 750 | 15.0 | 1/10 |
| 20 | 1,310 | 15.5 | " |
| 30 | 1,910 | 15.6 | " |
| 40 | 2,475 | 15.4 | " |
| 50 | 3,075 | 14.0 | " |
| 60 | 3,650 | 12.5 | " |
| 25 | 1,600 | 15.5 | " |
| 35 | 2,225 | 15.4 | " |
| 45 | 2,775 | 14.7 | " |
| 55 | 3,300 | 13.75 | " |

Mileage per cycle = 90 miles.
Total mileage accumulated over the 40-hour break-in period = 1,440 miles.

TABLE 3. FUEL SPECIFICATIONS

| | |
|---|---|
| Fuel No. | 7602 |
| Research octane No. | 91.5 |
| Motor octane No. | 83.8 |
| Reid vapor pressure, psig | 11.9 |
| Distillation, °F: | |
| 10 pct | 134 |
| 50 pct | 214 |
| 95 pct | 388 |
| 100 pct | 418 |
| API gravity, deg | 67.0 |
| FIA analysis, pct: | |
| Aromatics | 11 |
| Olefins | 16 |
| Paraffins | 73 |
| Sulfur, pct | 0.024 |
| Lead, g/gal | Trace |
| Hydrogen/carbon atomic ratio | 2.090 |

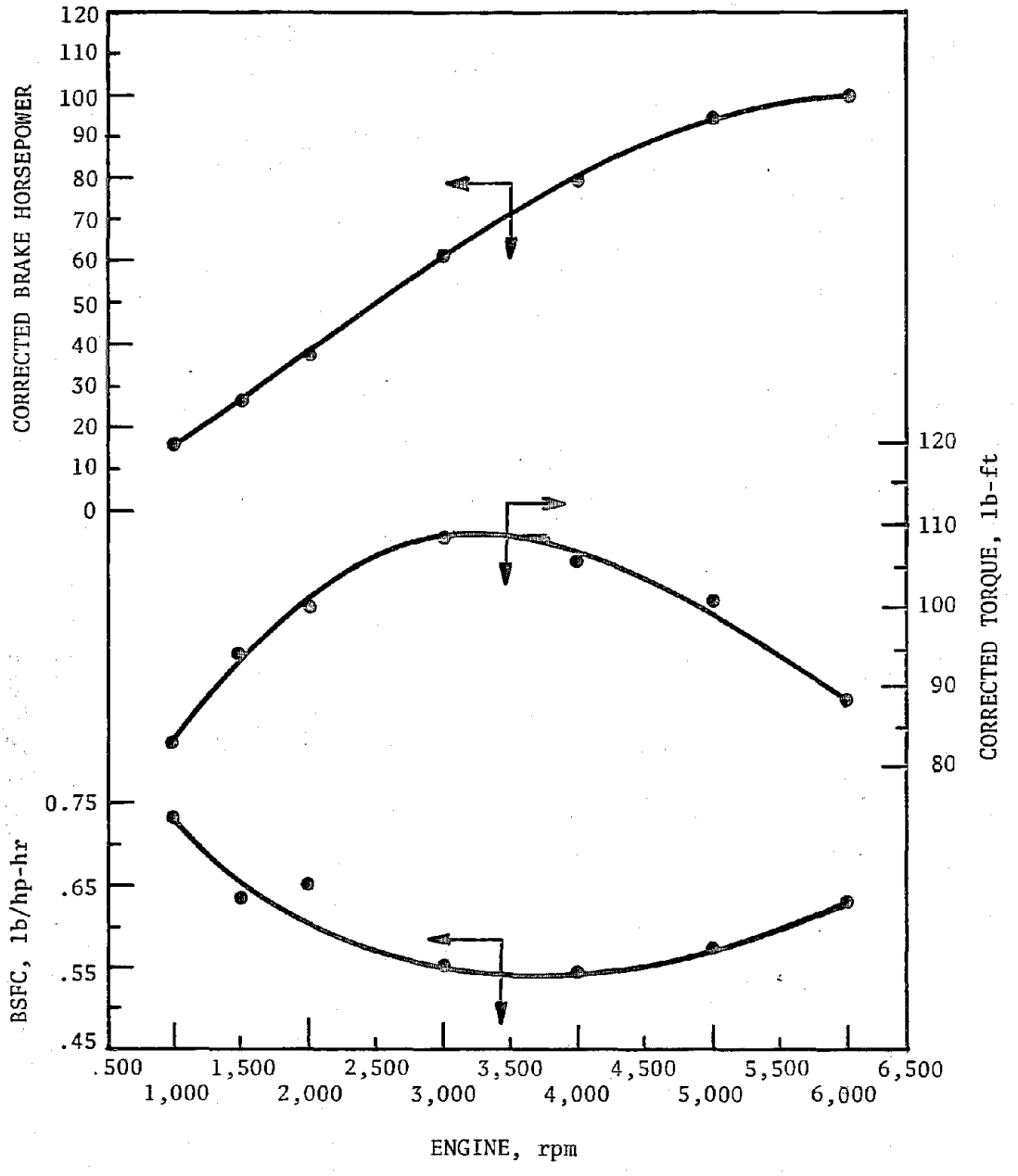



FIGURE 1. Brake Specific Fuel Consumption, Torque, and Brake Horsepower versus Engine rpm at Wide-Open Throttle--Mazda RX-3 Engine.

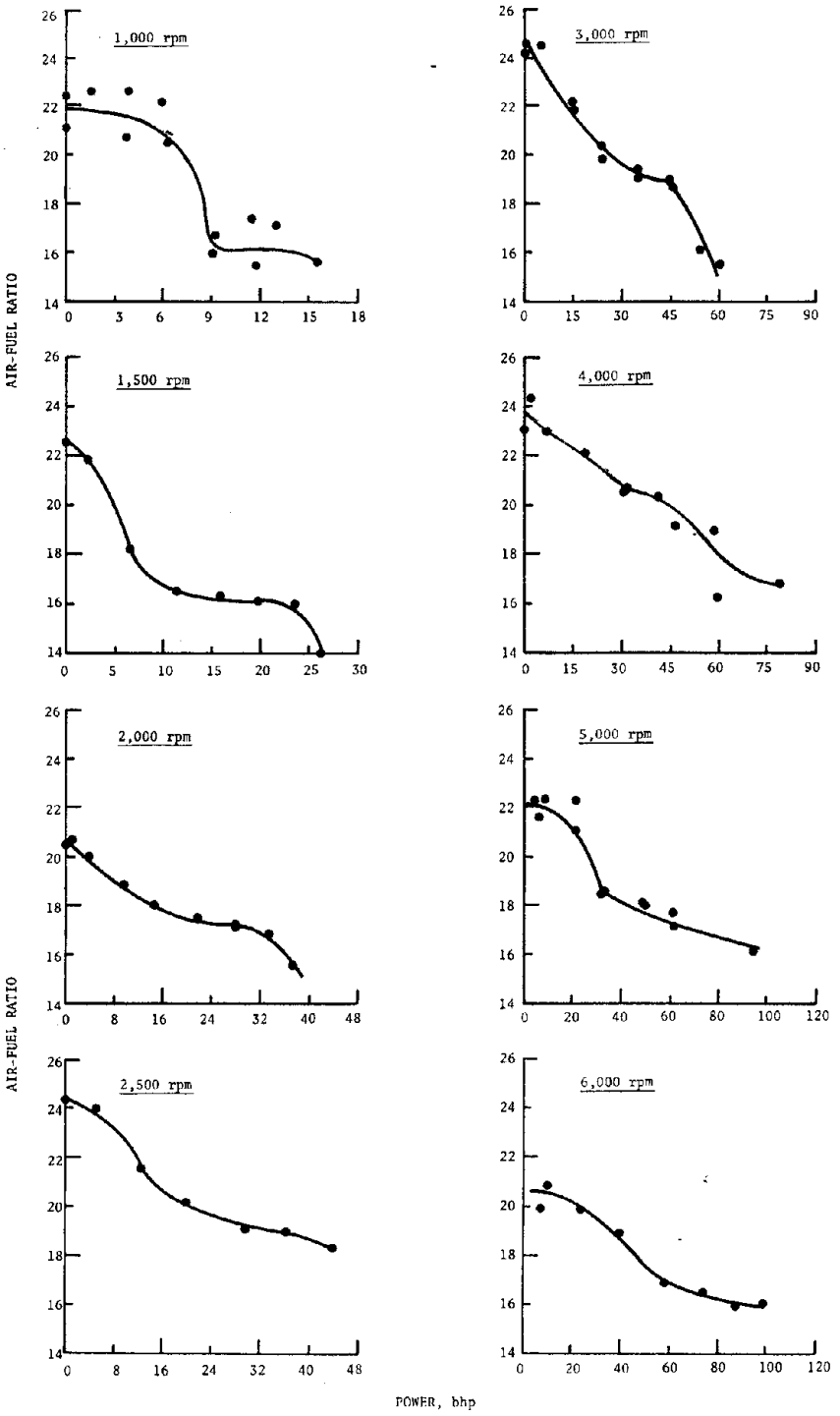



FIGURE 2. Air/Fuel Ratio versus Power at Various Speed and Load Conditions--Mazda RX-3 Engine.

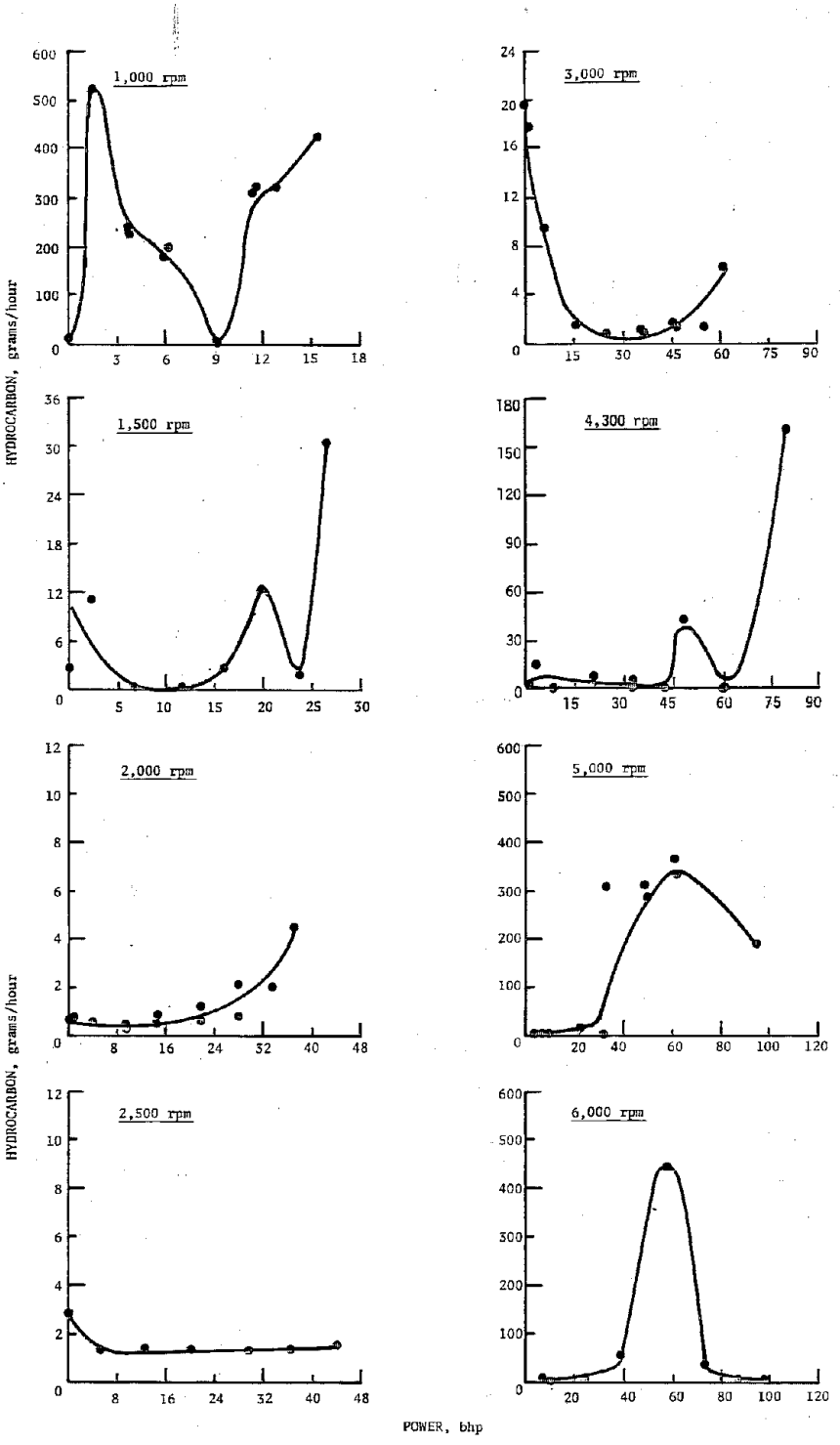



FIGURE 3. Hydrocarbon Emissions versus Power at Various Speed and Load Conditions--Mazda RX-3 Engine.

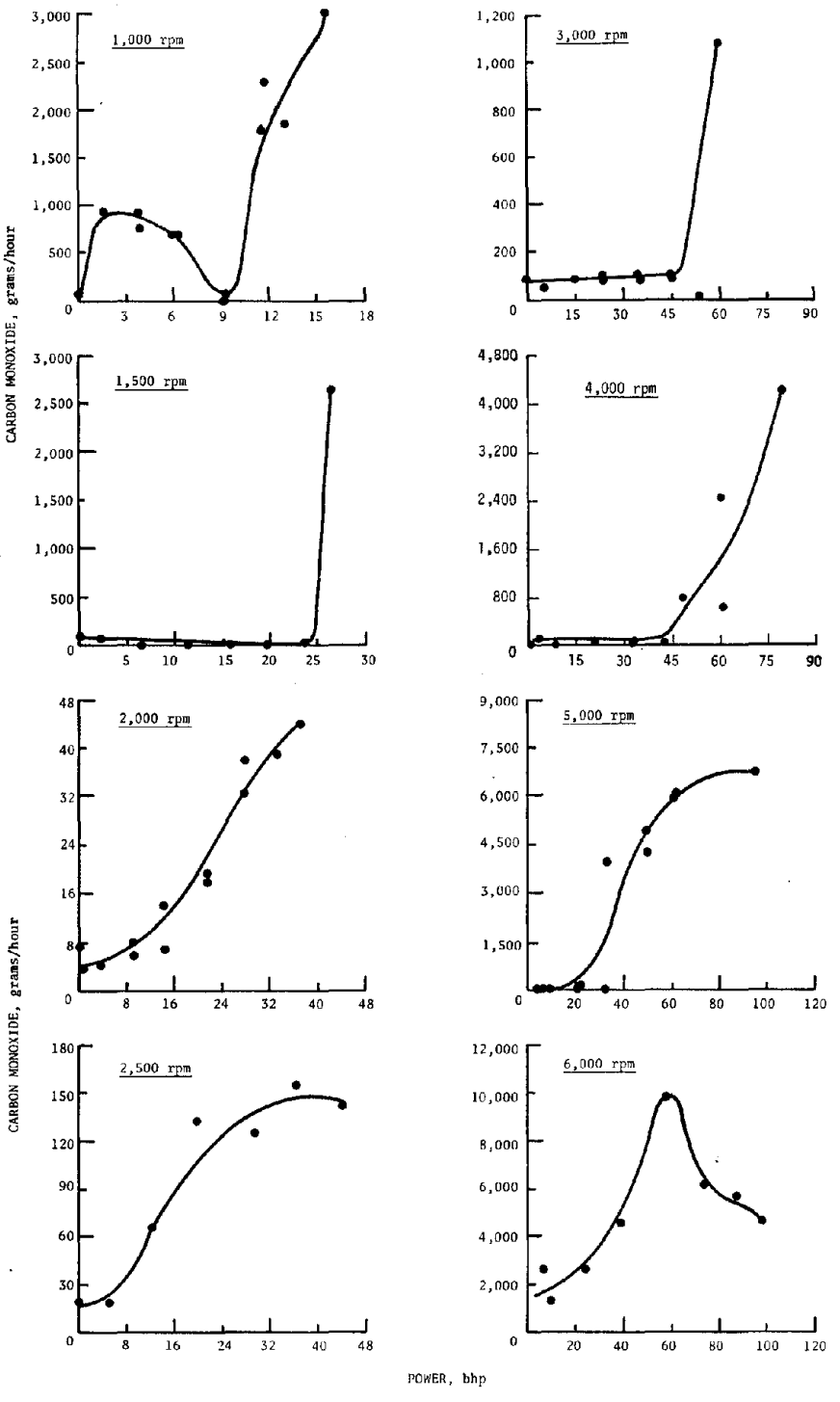



FIGURE 4. Carbon Monoxide Emissions versus Power at Various Speed and Load Conditions--Mazda RX-3 Engine.

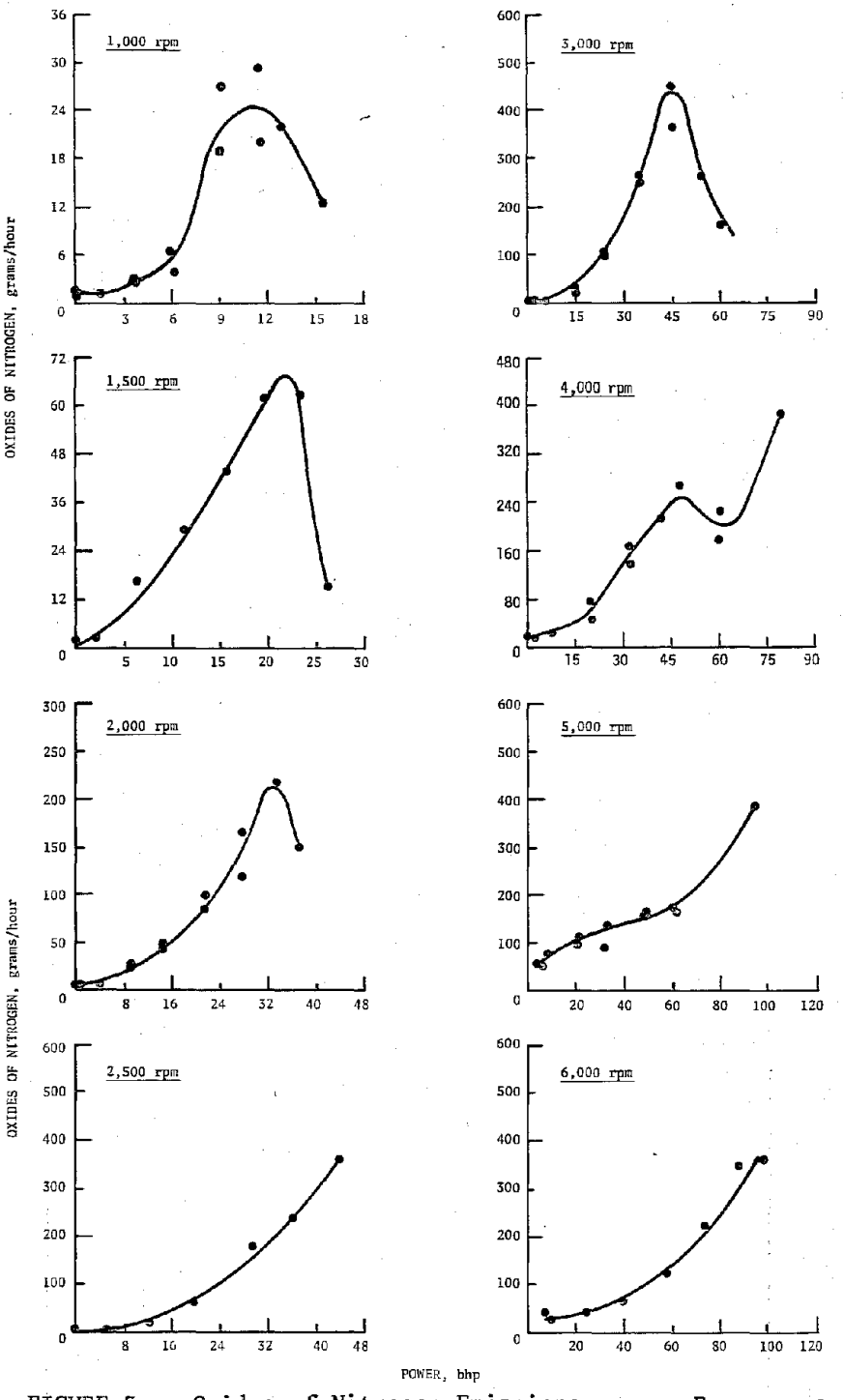



FIGURE 5. Oxides of Nitrogen Emissions versus Power at Various Speed and Load Conditions--Mazda RX-3 Engine.

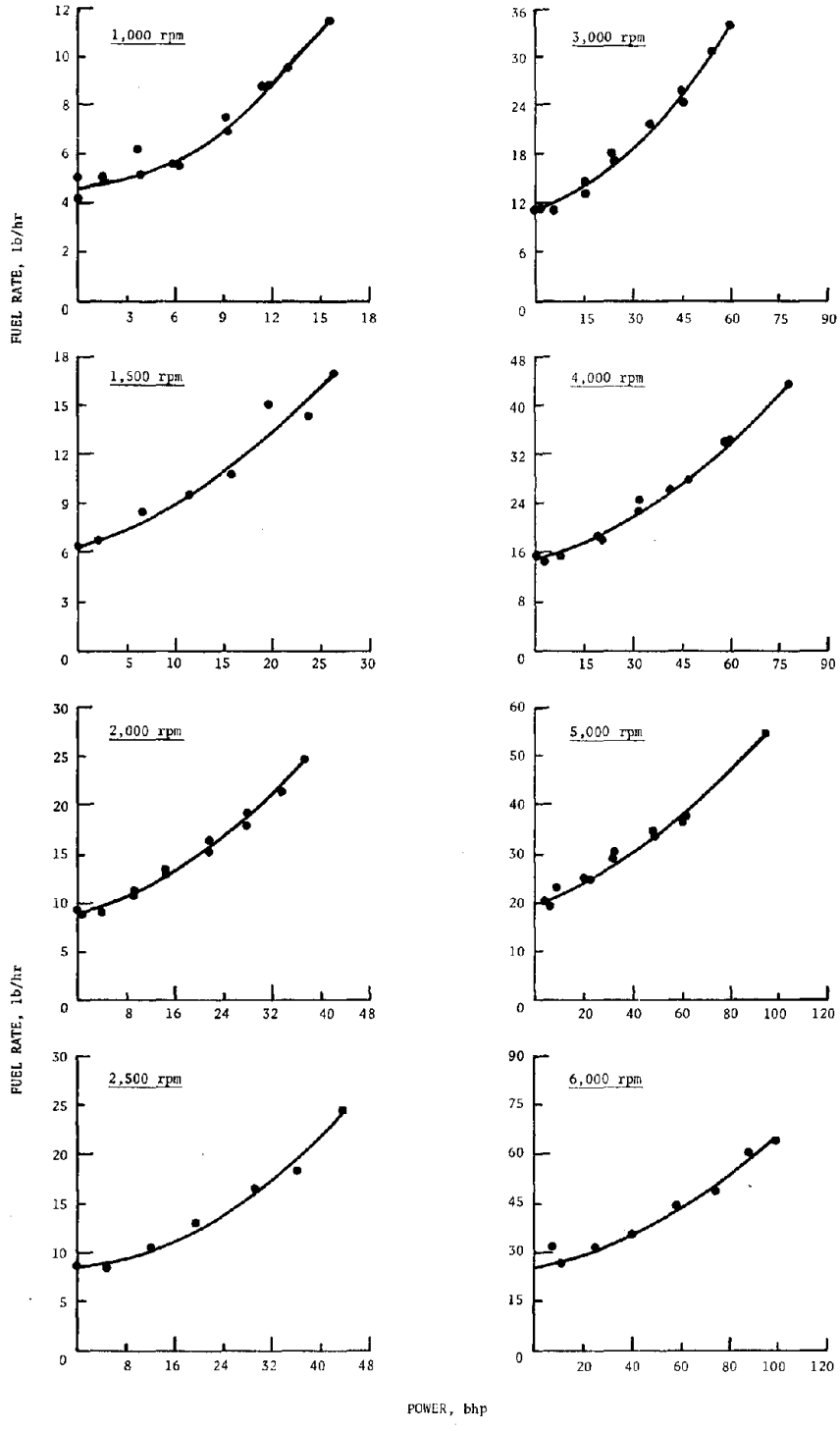



FIGURE 6. Fuel Rate versus Power at Various Speed and Load Conditions--Mazda RX-3 Engine.

Engine..... Mazda Rotary
Fuel..... 7602

| Test Number..... | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Test Date..... | 2/23/76 | 2/23/76 | 2/23/76 | 2/23/76 | 2/23/76 |
| Barometer, mm Hg..... | 750.7 | 750.7 | 750.7 | 750.7 | 750.7 |
| Humidity, grains/lb..... | 40 | 40 | 40 | 40 | 40 |
| Temperature, F..... | 80 | 80 | 81 | 80 | 82 |
| Engine speed, rpm..... | 700 | 700 | 700 | 750 | 750 |
| Torque, lb-ft..... | 0.0 | 8.0 | 15.0 | 0.0 | 8.0 |
| Power, bhp*..... | 0.0 | 1.1 | 2.0 | 0.0 | 1.1 |
| Fuel rate, lb/hr..... | 3.5 | 4.6 | 4.9 | 4.9 | 5.1 |
| Ignition timing, deg BTC.... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Manifold vacuum, in Hg..... | 15.0 | 15.0 | 14.0 | 14.5 | 14.0 |
| Throttle angle, deg..... | 0.0 | .5 | 1.0 | .5 | 1.0 |
| Concentrations, dry basis: | | | | | |
| CO, %..... | .0240 | .0630 | .1511 | .0378 | .0964 |
| CO2, %..... | 11.55 | 11.33 | 11.33 | 11.11 | 11.18 |
| O2, %..... | 4.83 | 5.08 | 5.08 | 5.50 | 5.45 |
| HC, ppmC..... | 32 | 145 | 839 | 78 | 279 |
| NOx, ppm..... | 22 | 24 | 42 | 23 | 23 |
| Air-fuel ratio..... | 18.98 | 19.21 | 19.02 | 19.70 | 19.54 |
| Emission rates, g/hr: | | | | | |
| CO..... | 6.5 | 23.1 | 58.0 | 15.1 | 39.7 |
| HC..... | .4 | 2.7 | 16.2 | 1.6 | 5.8 |
| NOx**..... | .9 | 1.2 | 2.3 | 1.3 | 1.3 |
| Oil temperature, F..... | 179 | 181 | 182 | 182 | 181 |
| Oil pressure, psi..... | 16 | 16 | 16 | 16 | 16 |
| Coolant temperature, F..... | 182 | 178 | 182 | 177 | 182 |
| Exhaust temperature, F..... | 1409 | 1358 | 1268 | 1418 | 1386 |
| Exhaust pressure, in H2O.... | 5.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| Intake man. temp., F..... | 146 | 146 | 148 | 147 | 149 |

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Mazda Rotary
Fuel..... 7602

| Test Number..... | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|
| Test Date..... | 2/23/76 | 2/24/76 | 2/24/76 | 2/24/76 | 3/13/76 |
| Barometer, mm Hg..... | 750.7 | 742.0 | 742.0 | 742.0 | 752.3 |
| Humidity, grains/lb..... | 40 | 44 | 44 | 44 | 19 |
| Temperature, F..... | 81 | 82 | 83 | 82 | 79 |
| Engine speed, rpm..... | 750 | 800 | 800 | 800 | 1000 |
| Torque, lb-ft..... | 15.0 | 0.0 | 8.0 | 15.0 | 84.4 |
| Power, bhp*..... | 2.1 | 0.0 | 1.2 | 2.3 | 15.7 |
| Fuel rate, lb/hr..... | 5.3 | 3.6 | 4.2 | 5.7 | 11.5 |
| Ignition timing, deg BTC.... | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 |
| Manifold vacuum, in Hg..... | 13.5 | 14.5 | 13.5 | 12.5 | .4 |
| Throttle angle, deg..... | 1.5 | 0.0 | 1.0 | 1.5 | 65.0 |
| Concentrations, dry basis: | | | | | |
| CO, %..... | .7525 | .0309 | .1603 | 1.4124 | 4.0400 |
| CO2, %..... | 9.70 | 10.99 | 10.70 | 8.10 | 8.19 |
| O2, %..... | 7.00 | 5.33 | 5.75 | 8.00 | 5.48 |
| HC, ppmC..... | 9124 | 189 | 834 | 12029 | 11092 |
| NOx, ppm..... | 30 | 25 | 25 | 29 | 126 |
| Air-fuel ratio..... | 19.30 | 19.59 | 19.84 | 19.65 | 15.55 |
| Emission rates, g/hr: | | | | | |
| CO..... | 322.7 | 9.1 | 55.7 | 663.3 | 3044.8 |
| HC..... | 196.9 | 2.8 | 14.6 | 284.3 | 420.7 |
| NOx**..... | 1.8 | 1.0 | 1.2 | 2.0 | 12.4 |
| Oil temperature, F..... | 179 | 179 | 178 | 177 | 177 |
| Oil pressure, psi..... | 16 | 17 | 16 | 16 | 16 |
| Coolant temperature, F..... | 180 | 182 | 180 | 176 | 176 |
| Exhaust temperature, F..... | 1233 | 1443 | 1375 | 1124 | 937 |
| Exhaust pressure, in H2O.... | 2.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Intake man. temp., F..... | 146 | 147 | 149 | 150 | 132 |

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Mazda Rotary
Fuel..... 7602

| Test Number..... | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|
| Test Date..... | 3/13/76 | 3/13/76 | 2/24/76 | 3/13/76 | 3/13/76 |
| Barometer, mm Hg..... | 752.3 | 752.3 | 742.0 | 752.3 | 752.3 |
| Humidity, grains/lb..... | 19 | 19 | 44 | 19 | 19 |
| Temperature, F..... | 78 | 78 | 81 | 78 | 77 |
| Engine speed, rpm..... | 1000 | 1000 | 1000 | 1000 | 1000 |
| Torque, lb-ft..... | 70.3 | 62.4 | 49.2 | 32.5 | 21.1 |
| Power, bhp*..... | 13.1 | 11.6 | 9.4 | 6.0 | 3.9 |
| Fuel rate, lb/hr..... | 9.5 | 8.8 | 7.8 | 5.6 | 5.2 |
| Ignition timing, deg BTC.... | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Manifold vacuum, in Hg..... | 4.0 | 5.5 | 8.5 | 10.0 | 12.0 |
| Throttle angle, deg..... | 16.0 | 13.0 | 7.0 | 6.0 | 4.2 |
| Concentrations, dry basis: | | | | | |
| CO, %..... | 2.7600 | 2.8200 | .0240 | 1.3200 | 1.5300 |
| CO2, %..... | 8.73 | 8.55 | 13.80 | 7.64 | 6.94 |
| O2, %..... | 6.05 | 6.45 | 1.45 | 8.98 | 9.75 |
| HC, ppmC..... | 9419 | 9627 | 54 | 6855 | 9197 |
| NOx, ppm..... | 250 | 350 | 300 | 94 | 39 |
| Air-fuel ratio..... | 17.02 | 17.29 | 15.92 | 22.05 | 22.51 |
| Emission rates, g/hr: | | | | | |
| CO..... | 1859.6 | 1803.0 | 12.1 | 689.2 | 751.2 |
| HC..... | 319.4 | 309.7 | 1.4 | 180.1 | 227.2 |
| NOx**..... | 21.9 | 29.1 | 21.7 | 6.4 | 2.5 |
| Oil temperature, F..... | 177 | 175 | 186 | 185 | 178 |
| Oil pressure, psi..... | 15 | 15 | 18 | 17 | 17 |
| Coolant temperature, F..... | 178 | 173 | 180 | 185 | 177 |
| Exhaust temperature, F..... | 929 | 903 | 1424 | 893 | 893 |
| Exhaust pressure, in H2O.... | 5.0 | 5.0 | 6.0 | 2.5 | 2.5 |
| Intake man. temp., F..... | 125 | 125 | 135 | 122 | 122 |

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Mazda Rotary
Fuel..... 7602

| Test Number..... | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|
| Test Date..... | 3/13/76 | 3/13/76 | 2/24/76 | 2/24/76 | 2/24/76 |
| Barometer, mm Hg..... | 752.3 | 752.3 | 742.0 | 742.0 | 742.0 |
| Humidity, grains/lb..... | 19 | 19 | 44 | 44 | 44 |
| Temperature, F..... | 78 | 78 | 82 | 84 | 84 |
| Engine speed, rpm..... | 1000 | 1000 | 1500 | 1500 | 1500 |
| Torque, lb-ft..... | 8.4 | 0.0 | 93.0 | 83.7 | 69.7 |
| Power, bhp*..... | 1.6 | 0.0 | 26.6 | 23.9 | 19.9 |
| Fuel rate, lb/hr..... | 5.1 | 4.2 | 16.9 | 14.2 | 15.0 |
| Ignition timing, deg BTC.... | 1.0 | 1.0 | 5.0 | 5.0 | 5.0 |
| Manifold vacuum, in Hg..... | 13.0 | 14.5 | .4 | 2.6 | 6.0 |
| Throttle angle, deg..... | 4.0 | 1.9 | 65.5 | 25.0 | 18.0 |
| Concentrations, dry basis: | | | | | |
| CO, %..... | 1.9200 | .1769 | 2.7875 | .0263 | .0169 |
| CO2, %..... | 5.20 | 9.69 | 12.88 | 13.80 | 13.53 |
| O2, %..... | 11.75 | 7.63 | .25 | 1.53 | 1.68 |
| HC, ppmC..... | 21319 | 551 | 634 | 38 | 251 |
| NOx, ppm..... | 21 | 21 | 109 | 470 | 435 |
| Air-fuel ratio..... | 22.47 | 22.24 | 13.79 | 15.99 | 16.10 |
| Emission rates, g/hr: | | | | | |
| CO..... | 938.0 | 67.8 | 2649.8 | 24.3 | 16.6 |
| HC..... | 524.1 | 10.6 | 30.3 | 1.8 | 12.4 |
| NOx**..... | 1.3 | 1.0 | 14.8 | 62.2 | 61.3 |
| Oil temperature, F..... | 183 | 180 | 191 | 189 | 185 |
| Oil pressure, psi..... | 19 | 20 | 27 | 29 | 28 |
| Coolant temperature, F..... | 183 | 180 | 173 | 187 | 185 |
| Exhaust temperature, F..... | 757 | 1406 | 1656 | 1570 | 1566 |
| Exhaust pressure, in H2O.... | 2.5 | 2.5 | 21.0 | 19.0 | 16.0 |
| Intake man. temp., F..... | 124 | 129 | 108 | 149 | 152 |

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Mazda Rotary
Fuel..... 7602

| Test Number..... | 21 | 22 | 23 | 24 | 25 |
|---|---|---|---|---|---|
| Test Date..... | 2/25/76 | 2/25/76 | 2/25/76 | 3/12/76 | 2/25/76 |
| Barometer, mm Hg..... | 741.1 | 741.1 | 741.1 | 747.0 | 741.1 |
| Humidity, grains/lb..... | 42 | 42 | 42 | 31 | 42 |
| Temperature, F..... | 84 | 84 | 84 | 87 | 84 |
| Engine speed, rpm..... | 1500 | 1500 | 1500 | 1500 | 1500 |
| Torque, lb-ft..... | 55.8 | 40.0 | 23.2 | 7.9 | 0.0 |
| Power, bhp*..... | 16.0 | 11.5 | 6.6 | 2.2 | 0.0 |
| Fuel rate, lb/hr..... | 10.7 | 9.5 | 8.4 | 6.7 | 6.3 |
| Ignition timing, deg BTC.... | 4.0 | 4.0 | 4.0 | 5.0 | 5.0 |
| Manifold vacuum, in Hg..... | 8.5 | 12.0 | 14.5 | 15.0 | 16.0 |
| Throttle angle, deg..... | 15.0 | 9.0 | 6.0 | 5.0 | 4.9 |
| Concentrations, dry basis: | | | | | |
| CO, %..... | .0073 | .0073 | .0059 | .0988 | .1534 |
| CO2, %..... | 13.53 | 13.36 | 12.02 | 9.67 | 9.50 |
| O2, %..... | 1.93 | 2.13 | 3.95 | 7.00 | 7.60 |
| HC, ppmC..... | 68 | 10 | 7 | 358 | 88 |
| NOx, ppm..... | 430 | 320 | 183 | 28 | 23 |
| Air-fuel ratio..... | 16.30 | 16.47 | 18.13 | 21.78 | 22.50 |
| Emission rates, g/hr: | | | | | |
| CO..... | 5.2 | 4.7 | 3.7 | 59.8 | 90.2 |
| HC..... | 2.5 | .3 | .2 | 10.9 | 2.6 |
| NOx**..... | 43.6 | 29.2 | 16.3 | 2.3 | 1.9 |
| Oil temperature, F..... | 185 | 185 | 186 | 179 | 186 |
| Oil pressure, psi..... | 30 | 31 | 37 | 32 | 39 |
| Coolant temperature, F..... | 182 | 178 | 176 | 178 | 177 |
| Exhaust temperature, F..... | 1539 | 1540 | 1494 | 1396 | 1436 |
| Exhaust pressure, in H20.... | 15.0 | 10.0 | 8.0 | 5.0 | 6.0 |
| Intake man. temp., F..... | 146 | 153 | 156 | 152 | 156 |

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Mazda Rotary
Fuel..... 7602

| Test Number..... | 26 | 27 | 28 | 29 | 30 |
|---|---|---|---|---|---|
| Test Date..... | 2/25/76 | 2/25/76 | 2/25/76 | 2/25/76 | 2/25/76 |
| Barometer, mm Hg..... | 741.1 | 741.1 | 741.1 | 741.1 | 741.1 |
| Humidity, grains/lb..... | 42 | 42 | 42 | 42 | 42 |
| Temperature, F..... | 85 | 85 | 85 | 85 | 85 |
| Engine speed, rpm..... | 2000 | 2000 | 2000 | 2000 | 2000 |
| Torque, lb-ft..... | 98.0 | 88.2 | 73.5 | 57.0 | 38.0 |
| Power, bhp*..... | 37.5 | 33.7 | 28.1 | 21.8 | 14.5 |
| Fuel rate, lb/hr..... | 24.4 | 21.1 | 19.0 | 16.2 | 12.9 |
| Ignition timing, deg BTC.... | 11.0 | 10.0 | 10.0 | 9.5 | 9.5 |
| Manifold vacuum, in Hg..... | .5 | 3.7 | 6.5 | 10.0 | 13.5 |
| Throttle angle, deg..... | 66.0 | 31.0 | 23.2 | 16.1 | 11.0 |
| Concentrations, dry basis: | | | | | |
| CO, %..... | .0286 | .0270 | .0286 | .0169 | .0073 |
| CO2, %..... | 14.13 | 13.01 | 12.75 | 12.52 | 12.13 |
| O2, %..... | .98 | 2.49 | 2.83 | 3.25 | 3.80 |
| HC, ppmC..... | 57 | 28 | 12 | 10 | 11 |
| NOx, ppm..... | 680 | 1050 | 875 | 595 | 335 |
| Air-fuel ratio..... | 15.58 | 16.80 | 17.09 | 17.46 | 17.98 |
| Emission rates, g/hr: | | | | | |
| CO..... | 44.1 | 39.1 | 38.0 | 19.6 | 7.0 |
| HC..... | 4.5 | 2.0 | .8 | .6 | .5 |
| NOx**..... | 149.2 | 216.4 | 165.2 | 98.3 | 45.4 |
| Oil temperature, F..... | 190 | 190 | 191 | 189 | 186 |
| Oil pressure, psi..... | 41 | 36 | 38 | 44 | 44 |
| Coolant temperature, F..... | 174 | 170 | 175 | 179 | 176 |
| Exhaust temperature, F..... | 1702 | 1554 | 1531 | 1512 | 1510 |
| Exhaust pressure, in H2O.... | 35.0 | 30.0 | 15.0 | 10.0 | 12.0 |
| Intake man. temp., F..... | 106 | 151 | 149 | 146 | 149 |

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Mazda Rotary
Fuel..... 7602

| Test Number..... | 31 | 32 | 33 | 35 | 36 |
|---|---|---|---|---|---|
| Test Date..... | 2/25/76 | 2/25/76 | 2/25/76 | 3/12/76 | 3/12/76 |
| Barometer, mm Hg..... | 741.1 | 741.1 | 741.1 | 747.0 | 747.0 |
| Humidity, grains/lb..... | 42 | 42 | 42 | 31 | 31 |
| Temperature, F..... | 85 | 85 | 85 | 84 | 84 |
| Engine speed, rpm..... | 2000 | 2000 | 2000 | 2500 | 2500 |
| Torque, lb-ft..... | 24.5 | 9.8 | 1.5 | 94.0 | 78.0 |
| Power, bhp*..... | 9.4 | 3.7 | .6 | 44.4 | 36.8 |
| Fuel rate, lb/hr..... | 10.8 | 8.9 | 8.8 | 24.4 | 18.2 |
| Ignition timing, deg BTC.... | 10.0 | 10.0 | 10.0 | 16.0 | 16.0 |
| Manifold vacuum, in Hg..... | 15.5 | 17.0 | 17.5 | 4.5 | 7.5 |
| Throttle angle, deg..... | 8.0 | 6.1 | 6.0 | 39.5 | 28.0 |
| Concentrations, dry basis: | | | | | |
| CO, %..... | .0073 | .0059 | .0049 | .0892 | .1084 |
| CO2, %..... | 11.55 | 10.90 | 10.54 | 11.83 | 11.43 |
| O2, %..... | 4.60 | 5.67 | 6.13 | 4.18 | 4.80 |
| HC, ppmC..... | 8 | 16 | 21 | 18 | 18 |
| NOx, ppm..... | 200 | 71 | 60 | 1660 | 1225 |
| Air-fuel ratio..... | 18.81 | 19.99 | 20.60 | 18.36 | 18.97 |
| Emission rates, g/hr: | | | | | |
| CO..... | 6.1 | 4.3 | 3.7 | 141.8 | 154.0 |
| HC..... | .4 | .6 | .8 | 1.4 | 1.3 |
| NOx**..... | 23.8 | 7.4 | 6.4 | 358.8 | 236.7 |
| Oil temperature, F..... | 190 | 184 | 183 | 190 | 184 |
| Oil pressure, psi..... | 47 | 50 | 52 | 45 | 46 |
| Coolant temperature, F..... | 184 | 179 | 182 | 178 | 179 |
| Exhaust temperature, F..... | 1537 | 1573 | 1592 | 1364 | 1325 |
| Exhaust pressure, in H2O.... | 10.0 | 8.0 | 8.0 | 30.0 | 25.0 |
| Intake man. temp., F..... | 154 | 159 | 158 | 144 | 142 |

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Mazda Rotary
Fuel..... 7602

| Test Number..... | 37 | 38 | 39 | 40 | 41 |
|---|---|---|---|---|---|
| Test Date..... | 2/25/76 | 2/25/76 | 2/25/76 | 2/25/76 | 2/25/76 |
| Barometer, mm Hg..... | 741.1 | 741.1 | 741.1 | 741.1 | 741.1 |
| Humidity, grains/lb..... | 42 | 42 | 42 | 42 | 42 |
| Temperature, F..... | 84 | 85 | 85 | 85 | 85 |
| Engine speed, rpm..... | 2500 | 2500 | 2500 | 2500 | 2500 |
| Torque, lb-ft..... | 62.4 | 41.6 | 26.0 | 10.4 | 0.0 |
| Power, bhp*..... | 29.8 | 19.9 | 12.4 | 5.0 | 0.0 |
| Fuel rate, lb/hr..... | 16.4 | 12.9 | 10.5 | 8.5 | 8.5 |
| Ignition timing, deg BTC.... | 14.5 | 15.0 | 14.2 | 14.0 | 14.0 |
| Manifold vacuum, in Hg..... | 9.0 | 13.0 | 15.0 | 18.0 | 18.0 |
| Throttle angle, deg..... | 24.0 | 16.0 | 11.2 | 8.0 | 7.9 |
| Concentrations, dry basis: | | | | | |
| CO, %..... | .0964 | .1229 | .0700 | .0216 | .0216 |
| CO2, %..... | 11.22 | 10.67 | 9.99 | 8.98 | 8.83 |
| O2, %..... | 4.89 | 5.85 | 6.83 | 8.33 | 8.50 |
| HC, ppmC..... | 19 | 23 | 27 | 31 | 66 |
| NOx, ppm..... | 950 | 395 | 143 | 51 | 56 |
| Air-fuel ratio..... | 19.12 | 20.15 | 21.51 | 23.95 | 24.29 |
| Emission rates, g/hr: | | | | | |
| CO..... | 124.7 | 132.0 | 65.7 | 18.4 | 18.6 |
| HC..... | 1.2 | 1.3 | 1.3 | 1.3 | 2.8 |
| NOx**..... | 174.8 | 60.4 | 19.1 | 6.2 | 6.9 |
| Oil temperature, F..... | 191 | 191 | 193 | 190 | 190 |
| Oil pressure, psi..... | 55 | 57 | 60 | 61 | 61 |
| Coolant temperature, F..... | 184 | 185 | 181 | 183 | 182 |
| Exhaust temperature, F..... | 1419 | 1393 | 1416 | 1483 | 1496 |
| Exhaust pressure, in H2O.... | 28.0 | 20.0 | 14.0 | 10.0 | 10.0 |
| Intake man. temp., F..... | 136 | 136 | 136 | 144 | 143 |

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Mazda Rotary
Fuel..... 7602

| Test Number..... | 47 | 48 | 49 | 50 | 52 |
|---|---|---|---|---|---|
| Test Date..... | 2/26/76 | 2/26/76 | 2/26/76 | 3/12/76 | 3/12/76 |
| Barometer, mm Hg..... | 748.3 | 748.3 | 748.3 | 747.0 | 747.0 |
| Humidity, grains/lb..... | 37 | 37 | 37 | 31 | 31 |
| Temperature, F..... | 84 | 84 | 85 | 84 | 84 |
| Engine speed, rpm..... | 3000 | 3000 | 3000 | 4000 | 4000 |
| Torque, lb-ft..... | 27.0 | 10.0 | 2.0 | 105.0 | 79.0 |
| Power, bhp*..... | 15.3 | 5.7 | 1.1 | 79.3 | 59.7 |
| Fuel rate, lb/hr..... | 14.5 | 11.0 | 11.3 | 43.1 | 33.8 |
| Ignition timing, deg BTC.... | 16.0 | 16.5 | 16.5 | 16.0 | 16.0 |
| Manifold vacuum, in Hg..... | 15.5 | 18.0 | 18.0 | 2.5 | 7.0 |
| Throttle angle, deg..... | 15.0 | 11.0 | 10.5 | 58.0 | 42.0 |
| Concentrations, dry basis: | | | | | |
| CO, %..... | .0630 | .0470 | .0748 | 1.4200 | .9288 |
| CO2, %..... | 9.85 | 8.83 | 8.74 | 11.55 | 10.57 |
| O2, %..... | 7.30 | 8.75 | 8.75 | 3.57 | 5.32 |
| HC, ppmC..... | 22 | 164 | 306 | 1073 | 5 |
| NOx, ppm..... | 193 | 62 | 50 | 950 | 490 |
| Air-fuel ratio..... | 22.08 | 24.49 | 24.50 | 16.76 | 18.92 |
| Emission rates, g/hr: | | | | | |
| CO..... | 83.9 | 52.9 | 86.3 | 4212.4 | 2456.6 |
| HC..... | 1.4 | 9.3 | 17.7 | 160.2 | .7 |
| NOx**..... | 35.8 | 9.7 | 8.0 | 383.2 | 176.2 |
| Oil temperature, F..... | 190 | 191 | 191 | 188 | 193 |
| Oil pressure, psi..... | 66 | 67 | 67 | 60 | 64 |
| Coolant temperature, F..... | 182 | 182 | 183 | 182 | 178 |
| Exhaust temperature, F..... | 1438 | 1503 | 1514 | 1495 | 1460 |
| Exhaust pressure, in H2O.... | 19.0 | 13.0 | 12.0 | 70.0 | 41.0 |
| Intake man. temp., F..... | 137 | 140 | 139 | 166 | 134 |

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Mazda Rotary
Fuel..... 7602

| Test Number..... | 53 | 54 | 55 | 56 | 57 |
|---|---|---|---|---|---|
| Test Date..... | 2/26/76 | 2/26/76 | 2/26/76 | 3/12/76 | 2/27/76 |
| Barometer, mm Hg..... | 748.3 | 748.3 | 748.3 | 747.0 | 748.9 |
| Humidity, grains/lb..... | 37 | 37 | 37 | 31 | 34 |
| Temperature, F..... | 84 | 82 | 83 | 83 | 83 |
| Engine speed, rpm..... | 4000 | 4000 | 4000 | 4000 | 4000 |
| Torque, lb-ft..... | 63.0 | 42.0 | 26.0 | 10.0 | 3.0 |
| Power, bhp*..... | 47.6 | 31.7 | 19.6 | 7.5 | 2.3 |
| Fuel rate, lb/hr..... | 27.6 | 22.4 | 18.5 | 15.3 | 14.5 |
| Ignition timing, deg BTC.... | 17.0 | 16.0 | 17.0 | 16.0 | 16.0 |
| Manifold vacuum, in Hg..... | 9.5 | 12.0 | 15.0 | 17.5 | 17.5 |
| Throttle angle, deg..... | 40.0 | 30.0 | 22.5 | 17.0 | 15.5 |
| Concentrations, dry basis: | | | | | |
| CO, %..... | .3600 | .0193 | .0401 | .0169 | .0796 |
| CO2, %..... | 11.08 | 10.50 | 9.70 | 9.50 | 8.48 |
| O2, %..... | 5.25 | 6.05 | 7.20 | 7.88 | 8.30 |
| HC, ppmC..... | 391 | 14 | 44 | 9 | 212 |
| NOx, ppm..... | 880 | 620 | 310 | 117 | 78 |
| Air-fuel ratio..... | 19.17 | 20.55 | 22.13 | 23.01 | 24.30 |
| Emission rates, g/hr: | | | | | |
| CO..... | 786.1 | 36.8 | 68.4 | 24.7 | 117.6 |
| HC..... | 43.0 | 1.4 | 3.8 | .6 | 15.8 |
| NOx**..... | 267.7 | 164.6 | 73.7 | 23.2 | 15.9 |
| Oil temperature, F..... | 194 | 195 | 193 | 188 | 193 |
| Oil pressure, psi..... | 66 | 67 | 67 | 62 | 69 |
| Coolant temperature, F..... | 177 | 183 | 184 | 183 | 185 |
| Exhaust temperature, F..... | 1632 | 1566 | 1548 | 1594 | 1560 |
| Exhaust pressure, in H20.... | 56.0 | 52.0 | 39.0 | 18.0 | 25.0 |
| Intake man. temp., F..... | 138 | 137 | 136 | 129 | 140 |

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Mazda Rotary
Fuel..... 7602

| Test Number..... | 58 | 60 | 61 | 62 | 63 |
|---|---|---|---|---|---|
| Test Date..... | 3/17/76 | 3/12/76 | 3/12/76 | 2/27/76 | 2/27/76 |
| Barometer, mm Hg..... | 742.1 | 747.0 | 747.0 | 748.9 | 748.9 |
| Humidity, grains/lb..... | 38 | 31 | 31 | 34 | 34 |
| Temperature, F..... | 87 | 83 | 82 | 85 | 85 |
| Engine speed, rpm..... | 5000 | 5000 | 5000 | 5000 | 5000 |
| Torque, lb-ft..... | 100.0 | 65.0 | 52.0 | 34.0 | 21.8 |
| Power, bhp*..... | 95.5 | 61.3 | 49.0 | 32.1 | 20.5 |
| Fuel rate, lb/hr..... | 54.1 | 36.3 | 34.0 | 28.7 | 25.0 |
| Ignition timing, deg BTC.... | 16.0 | 16.0 | 16.0 | 16.0 | 16.0 |
| Manifold vacuum, in Hg..... | .5 | 11.0 | 11.5 | 13.5 | 14.0 |
| Throttle angle, deg..... | 83.0 | 50.0 | 43.0 | 31.0 | 29.0 |
| Concentrations, dry basis: | | | | | |
| CO, %..... | 1.8700 | 2.2400 | 1.9300 | .0097 | .0145 |
| CO2, %..... | 11.33 | 9.76 | 9.76 | 11.73 | 9.60 |
| O2, %..... | 3.10 | 5.40 | 5.60 | 4.25 | 7.20 |
| HC, ppmC..... | 1053 | 2734 | 2395 | 8 | 41 |
| NOx, ppm..... | 760 | 460 | 445 | 285 | 295 |
| Air-fuel ratio..... | 16.14 | 17.65 | 18.12 | 18.46 | 22.24 |
| Emission rates, g/hr: | | | | | |
| CO..... | 6723.1 | 5950.8 | 4928.2 | 21.2 | 33.6 |
| HC..... | 190.6 | 365.5 | 307.8 | .9 | 4.7 |
| NOx**..... | 382.4 | 166.2 | 154.5 | 85.6 | 94.1 |
| Oil temperature, F..... | 190 | 192 | 193 | 199 | 197 |
| Oil pressure, psi..... | 56 | 64 | 65 | 66 | 67 |
| Coolant temperature, F..... | 186 | 183 | 182 | 182 | 182 |
| Exhaust temperature, F..... | 1700 | 1481 | 1483 | 1837 | 1760 |
| Exhaust pressure, in H20.... | 128.0 | 52.0 | 50.0 | 65.0 | 50.0 |
| Intake man. temp., F..... | 183 | 135 | 134 | 145 | 137 |

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Mazda Rotary
Fuel..... 7602

| Test Number..... | 64 | 65 | 66 | 67 | 68 |
|---|---|---|---|---|---|
| Test Date..... | 2/27/76 | 2/27/76 | 3/11/76 | 3/12/76 | 3/11/76 |
| Barometer, mm Hg..... | 748.9 | 748.9 | 737.5 | 747.0 | 737.5 |
| Humidity, grains/lb..... | 34 | 34 | 27 | 31 | 27 |
| Temperature, F..... | 83 | 86 | 84 | 86 | 86 |
| Engine speed, rpm..... | 5000 | 5000 | 6000 | 6000 | 6000 |
| Torque, lb-ft..... | 8.7 | 4.0 | 87.0 | 78.3 | 65.3 |
| Power, bhp*..... | 8.2 | 3.8 | 99.8 | 88.9 | 75.0 |
| Fuel rate, lb/hr..... | 23.1 | 20.4 | 63.0 | 59.3 | 47.7 |
| Ignition timing, deg BTC.... | 16.0 | 16.0 | 15.0 | 15.0 | 15.0 |
| Manifold vacuum, in Hg..... | 15.0 | 15.5 | 1.0 | 3.5 | 5.0 |
| Throttle angle, deg..... | 27.0 | 24.0 | 76.0 | 64.0 | 58.0 |
| Concentrations, dry basis: | | | | | |
| CO, %..... | .0145 | .0121 | 1.1057 | 1.4539 | 1.8649 |
| CO2, %..... | 9.50 | 9.50 | 12.56 | 12.50 | 11.33 |
| O2, %..... | 7.20 | 7.12 | 2.43 | 2.50 | 3.50 |
| HC, ppmC..... | 40 | 49 | 29 | 23 | 226 |
| NOx, ppm..... | 245 | 200 | 650 | 655 | 510 |
| Air-fuel ratio..... | 22.31 | 22.23 | 16.12 | 15.98 | 16.54 |
| Emission rates, g/hr: | | | | | |
| CO..... | 31.1 | 22.9 | 4586.4 | 5630.1 | 6047.4 |
| HC..... | 4.3 | 4.7 | 6.1 | 4.4 | 36.9 |
| NOx**..... | 72.4 | 52.1 | 360.8 | 344.9 | 221.3 |
| Oil temperature, F..... | 199 | 196 | 200 | 196 | 186 |
| Oil pressure, psi..... | 67 | 67 | 50 | 49 | 50 |
| Coolant temperature, F..... | 183 | 182 | 182 | 184 | 183 |
| Exhaust temperature, F..... | 1795 | 1787 | 1714 | 1627 | 1584 |
| Exhaust pressure, in H2O.... | 40.0 | 38.0 | 0.0 | 0.0 | 125.0 |
| Intake man. temp., F..... | 137 | 138 | 196 | 85 | 92 |

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Mazda Rotary
Fuel..... 7602

| Test Number..... | 69 | 70 | 71 | 72 | 73 |
|---|---|---|---|---|---|
| Test Date..... | 3/13/76 | 3/11/76 | 3/11/76 | 3/11/76 | 3/11/76 |
| Barometer, mm Hg..... | 752.2 | 737.5 | 737.5 | 737.5 | 737.5 |
| Humidity, grains/lb..... | 19 | 27 | 27 | 27 | 27 |
| Temperature, F..... | 85 | 83 | 84 | 82 | 82 |
| Engine speed, rpm..... | 6000 | 6000 | 6000 | 6000 | 6000 |
| Torque, lb-ft..... | 52.2 | 34.8 | 21.4 | 8.7 | 6.0 |
| Power, bhp*..... | 58.7 | 39.9 | 24.5 | 10.0 | 6.9 |
| Fuel rate, lb/hr..... | 43.4 | 35.0 | 31.1 | 26.4 | 31.2 |
| Ignition timing, deg BTC.... | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 |
| Manifold vacuum, in Hg..... | 11.0 | 13.0 | 14.0 | 16.0 | 15.0 |
| Throttle angle, deg..... | 72.0 | 45.0 | 38.5 | 30.0 | 25.0 |
| Concentrations, dry basis: | | | | | |
| CO, %..... | 3.1870 | 1.6300 | .9984 | .5500 | .9900 |
| CO2, %..... | 8.97 | 9.58 | 9.79 | 9.69 | 9.79 |
| O2, %..... | 5.30 | 5.82 | 6.18 | 6.65 | 6.25 |
| HC, ppmC..... | 2866 | 411 | 58 | 24 | 67 |
| NOx, ppm..... | 305 | 168 | 125 | 81 | 115 |
| Air-fuel ratio..... | 16.96 | 18.94 | 19.89 | 20.91 | 19.96 |
| Emission rates, g/hr: | | | | | |
| CO..... | 9767.2 | 4491.3 | 2566.5 | 1259.3 | 2557.6 |
| HC..... | 442.0 | 57.0 | 7.5 | 2.8 | 8.6 |
| NOx**..... | 121.7 | 61.8 | 43.0 | 24.8 | 39.8 |
| Oil temperature, F..... | 194 | 193 | 193 | 192 | 191 |
| Oil pressure, psi..... | 52 | 55 | 57 | 59 | 60 |
| Coolant temperature, F..... | 184 | 182 | 182 | 184 | 184 |
| Exhaust temperature, F..... | 1522 | 1511 | 1640 | 1821 | 1754 |
| Exhaust pressure, in H20.... | 72.0 | 55.0 | 49.0 | 39.0 | 50.0 |
| Intake man. temp., F..... | 106 | 138 | 134 | 190 | 123 |

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Mazda Rotary
Fuel..... 7602

| Test Number..... | 74 | 75 | 76 | 77 | 78 |
|---|---|---|---|---|---|
| Test Date..... | 2/28/76 | 2/28/76 | 2/28/76 | 2/28/76 | 2/28/76 |
| Barometer, mm Hg..... | 741.2 | 741.2 | 741.2 | 741.2 | 741.2 |
| Humidity, grains/lb..... | 34 | 34 | 34 | 34 | 34 |
| Temperature, F..... | 81 | 83 | 82 | 83 | 83 |
| Engine speed, rpm..... | 1000 | 1000 | 1000 | 1000 | 1000 |
| Torque, lb-ft..... | 62.0 | 49.0 | 33.0 | 20.0 | 0.0 |
| Power, bhp*..... | 11.8 | 9.3 | 6.3 | 3.8 | 0.0 |
| Fuel rate, lb/hr..... | 8.8 | 6.9 | 5.5 | 6.2 | 5.1 |
| Ignition timing, deg BTC.... | 1.5 | 1.2 | 1.0 | 1.0 | 1.0 |
| Manifold vacuum, in Hg..... | 7.0 | 10.0 | 11.5 | 12.5 | 14.0 |
| Throttle angle, deg..... | 9.9 | 5.0 | 4.0 | 3.9 | 1.2 |
| Concentrations, dry basis: | | | | | |
| CO, %..... | 4.0500 | .1080 | 1.4800 | 1.7100 | .1890 |
| CO2, %..... | 8.33 | 13.27 | 7.89 | 7.47 | 9.84 |
| O2, %..... | 5.25 | 2.45 | 8.00 | 8.40 | 6.50 |
| HC, ppmC..... | 11108 | 54 | 8406 | 8818 | 635 |
| NOx, ppm..... | 255 | 415 | 60 | 36 | 27 |
| Air-fuel ratio..... | 15.38 | 16.65 | 20.37 | 20.62 | 21.00 |
| Emission rates, g/hr: | | | | | |
| CO..... | 2303.6 | 50.7 | 692.5 | 921.0 | 84.8 |
| HC..... | 318.0 | 1.3 | 198.0 | 239.0 | 14.3 |
| NOx**..... | 20.0 | 26.9 | 3.9 | 2.7 | 1.7 |
| Oil temperature, F..... | 186 | 187 | 189 | 187 | 186 |
| Oil pressure, psi..... | 17 | 18 | 17 | 20 | 21 |
| Coolant temperature, F..... | 181 | 185 | 177 | 178 | 175 |
| Exhaust temperature, F..... | 908 | 1305 | 886 | 900 | 1360 |
| Exhaust pressure, in H20.... | 5.0 | 5.0 | 4.0 | 4.0 | 3.0 |
| Intake man. temp., F..... | 134 | 127 | 128 | 128 | 134 |

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Mazda Rotary
Fuel..... 7602

| Test Number..... | 79 | 80 | 81 | 82 | 83 |
|---|---|---|---|---|---|
| Test Date..... | 2/28/76 | 2/28/76 | 2/28/76 | 2/28/76 | 2/28/76 |
| Barometer, mm Hg..... | 741.2 | 741.2 | 741.2 | 741.2 | 741.2 |
| Humidity, grains/lb..... | 34 | 34 | 34 | 34 | 34 |
| Temperature, F..... | 85 | 85 | 85 | 85 | 86 |
| Engine speed, rpm..... | 2000 | 2000 | 2000 | 2000 | 2000 |
| Torque, lb-ft..... | 73.5 | 57.0 | 38.0 | 24.5 | 0.0 |
| Power, bhp*..... | 28.0 | 21.7 | 14.5 | 9.3 | 0.0 |
| Fuel rate, lb/hr..... | 17.7 | 15.1 | 13.2 | 11.0 | 9.0 |
| Ignition timing, deg BTC.... | 12.0 | 11.4 | 11.4 | 11.4 | 11.2 |
| Manifold vacuum, in Hg..... | 8.0 | 9.9 | 13.0 | 15.0 | 17.0 |
| Throttle angle, deg..... | 19.2 | 15.5 | 11.0 | 8.0 | 6.0 |
| Concentrations, dry basis: | | | | | |
| CO, %..... | .0263 | .0169 | .0145 | .0097 | .0097 |
| CO2, %..... | 12.75 | 12.50 | 12.02 | 11.55 | 10.60 |
| O2, %..... | 2.97 | 3.27 | 3.85 | 4.55 | 5.90 |
| HC, ppmC..... | 34 | 21 | 17 | 11 | 19 |
| NOx, ppm..... | 690 | 570 | 358 | 225 | 59 |
| Air-fuel ratio..... | 17.19 | 17.47 | 18.04 | 18.76 | 20.35 |
| Emission rates, g/hr: | | | | | |
| CO..... | 32.7 | 18.2 | 14.2 | 8.2 | 7.4 |
| HC..... | 2.1 | 1.2 | .8 | .5 | .7 |
| NOx**..... | 118.3 | 84.7 | 48.4 | 26.3 | 6.2 |
| Oil temperature, F..... | 190 | 191 | 189 | 186 | 187 |
| Oil pressure, psi..... | 40 | 40 | 43 | 45 | 49 |
| Coolant temperature, F..... | 187 | 176 | 176 | 178 | 184 |
| Exhaust temperature, F..... | 1516 | 1506 | 1505 | 1500 | 1562 |
| Exhaust pressure, in H2O.... | 21.0 | 19.0 | 14.0 | 10.5 | 9.0 |
| Intake man. temp., F..... | 133 | 135 | 140 | 143 | 148 |

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Mazda Rotary
Fuel..... 7602

| Test Number..... | 84 | 85 | 86 | 87 | 88 |
|---|---|---|---|---|---|
| Test Date..... | 2/28/76 | 2/28/76 | 2/28/76 | 2/28/76 | 2/28/76 |
| Barometer, mm Hg..... | 741.2 | 741.2 | 741.2 | 741.2 | 741.2 |
| Humidity, grains/lb..... | 34 | 34 | 34 | 34 | 34 |
| Temperature, F..... | 85 | 86 | 86 | 86 | 86 |
| Engine speed, rpm..... | 3000 | 3000 | 3000 | 3000 | 3000 |
| Torque, lb-ft..... | 81.0 | 63.0 | 43.0 | 27.0 | 0.0 |
| Power, bhp*..... | 46.3 | 36.1 | 24.6 | 15.5 | 0.0 |
| Fuel rate, lb/hr..... | 24.2 | 21.7 | 17.9 | 13.2 | 11.1 |
| Ignition timing, deg BTC.... | 15.3 | 15.5 | 17.0 | 15.0 | 15.5 |
| Manifold vacuum, in Hg..... | 5.6 | 8.0 | 12.0 | 15.0 | 18.0 |
| Throttle angle, deg..... | 41.0 | 30.0 | 21.0 | 14.0 | 10.0 |
| Concentrations, dry basis: | | | | | |
| CO, %..... | .0493 | .0515 | .0584 | .0724 | .0796 |
| CO2, %..... | 11.55 | 11.33 | 10.80 | 9.79 | 8.55 |
| O2, %..... | 4.45 | 4.85 | 5.50 | 7.00 | 8.25 |
| HC, ppmC..... | 13 | 12 | 11 | 24 | 346 |
| NOx, ppm..... | 1413 | 1063 | 495 | 140 | 49 |
| Air-fuel ratio..... | 18.69 | 19.09 | 19.85 | 21.81 | 24.12 |
| Emission rates, g/hr: | | | | | |
| CO..... | 91.9 | 88.1 | 85.6 | 86.5 | 89.1 |
| HC..... | 1.3 | 1.0 | .8 | 1.4 | 19.5 |
| NOx**..... | 363.2 | 250.8 | 100.1 | 23.1 | 7.5 |
| Oil temperature, F..... | 195 | 196 | 193 | 190 | 191 |
| Oil pressure, psi..... | 58 | 59 | 62 | 63 | 66 |
| Coolant temperature, F..... | 179 | 182 | 183 | 184 | 181 |
| Exhaust temperature, F..... | 1512 | 1488 | 1466 | 1446 | 1518 |
| Exhaust pressure, in H2O.... | 50.0 | 41.0 | 30.0 | 19.0 | 12.0 |
| Intake man. temp., F..... | 145 | 144 | 141 | 141 | 144 |

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Mazda Rotary
Fuel..... 7602

| Test Number..... | 89 | 90 | 91 | 92 | 93 |
|---|---|---|---|---|---|
| Test Date..... | 2/28/76 | 3/12/76 | 2/28/76 | 2/28/76 | 2/28/76 |
| Barometer, mm Hg..... | 741.2 | 747.0 | 741.2 | 741.2 | 741.2 |
| Humidity, grains/lb..... | 34 | 31 | 34 | 34 | 34 |
| Temperature, F..... | 87 | 83 | 86 | 86 | 87 |
| Engine speed, rpm..... | 4000 | 4000 | 4000 | 4000 | 4000 |
| Torque, lb-ft..... | 79.0 | 55.4 | 42.0 | 26.0 | 0.0 |
| Power, bhp*..... | 60.4 | 41.8 | 32.1 | 19.9 | 0.0 |
| Fuel rate, lb/hr..... | 34.1 | 26.0 | 24.2 | 18.2 | 15.3 |
| Ignition timing, deg BTC.... | 17.0 | 16.0 | 16.0 | 16.0 | 16.0 |
| Manifold vacuum, in Hg..... | 6.0 | 10.0 | 12.0 | 15.0 | 17.0 |
| Throttle angle, deg..... | 51.0 | 38.0 | 29.0 | 20.0 | 15.5 |
| Concentrations, dry basis: | | | | | |
| CO, %..... | .2738 | .0240 | .0286 | .0378 | .0169 |
| CO2, %..... | 13.30 | 10.70 | 10.45 | 9.70 | 9.31 |
| O2, %..... | 2.05 | 5.90 | 6.15 | 7.25 | 7.75 |
| HC, ppmC..... | 8 | 6 | 52 | 91 | 47 |
| NOx, ppm..... | 720 | 710 | 480 | 203 | 93 |
| Air-fuel ratio..... | 16.27 | 20.31 | 20.65 | 22.17 | 23.03 |
| Emission rates, g/hr: | | | | | |
| CO..... | 620.0 | 52.4 | 59.2 | 63.3 | 24.8 |
| HC..... | .9 | .7 | 5.4 | 7.7 | 3.4 |
| NOx**..... | 224.9 | 210.6 | 137.0 | 46.9 | 18.7 |
| Oil temperature, F..... | 189 | 188 | 193 | 191 | 190 |
| Oil pressure, psi..... | 66 | 65 | 66 | 67 | 68 |
| Coolant temperature, F..... | 183 | 180 | 181 | 179 | 181 |
| Exhaust temperature, F..... | 1816 | 1542 | 1649 | 1644 | 1660 |
| Exhaust pressure, in H20.... | 85.0 | 40.0 | 40.0 | 29.0 | 20.0 |
| Intake man. temp., F..... | 125 | 132 | 139 | 138 | 141 |

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Mazda Rotary
Fuel..... 7602

| Test Number..... | 94 | 95 | 96 | 97 | 98 |
|---|---|---|---|---|---|
| Test Date..... | 2/28/76 | 2/28/76 | 3/ 4/76 | 3/ 4/76 | 3/ 4/76 |
| Barometer, mm Hg..... | 741.2 | 741.2 | 733.6 | 733.6 | 733.6 |
| Humidity, grains/lb..... | 34 | 34 | 80 | 80 | 80 |
| Temperature, F..... | 87 | 87 | 79 | 81 | 83 |
| Engine speed, rpm..... | 5000 | 5000 | 5000 | 5000 | 5000 |
| Torque, lb-ft..... | 65.0 | 52.0 | 34.0 | 22.0 | 6.0 |
| Power, bhp*..... | 62.1 | 49.7 | 32.9 | 21.3 | 5.8 |
| Fuel rate, lb/hr..... | 37.0 | 33.2 | 30.2 | 24.6 | 19.2 |
| Ignition timing, deg BTC.... | 16.5 | 16.0 | 16.0 | 16.5 | 16.5 |
| Manifold vacuum, in Hg..... | 10.0 | 11.0 | 13.0 | 14.0 | 15.5 |
| Throttle angle, deg..... | 55.0 | 45.0 | 36.0 | 33.5 | 23.0 |
| Concentrations, dry basis: | | | | | |
| CO, %..... | 2.3000 | 1.7100 | 1.7125 | .0309 | .0105 |
| CO2, %..... | 9.89 | 9.89 | 9.44 | 10.39 | 10.19 |
| O2, %..... | 4.82 | 5.20 | 5.75 | 6.50 | 7.00 |
| HC, ppmC..... | 2515 | 2284 | 2635 | 97 | 59 |
| NOx, ppm..... | 445 | 465 | 338 | 295 | 165 |
| Air-fuel ratio..... | 17.15 | 17.96 | 18.49 | 20.99 | 21.62 |
| Emission rates, g/hr: | | | | | |
| CO..... | 6049.9 | 4237.3 | 3973.6 | 66.1 | 18.0 |
| HC..... | 332.9 | 284.8 | 307.7 | 10.4 | 5.1 |
| NOx**..... | 161.4 | 158.9 | 132.2 | 106.4 | 47.8 |
| Oil temperature, F..... | 195 | 196 | 189 | 190 | 186 |
| Oil pressure, psi..... | 65 | 65 | 65 | 65 | 65 |
| Coolant temperature, F..... | 182 | 184 | 186 | 182 | 181 |
| Exhaust temperature, F..... | 1764 | 1618 | 1603 | 1759 | 1728 |
| Exhaust pressure, in H2O.... | 79.0 | 68.0 | 51.0 | 50.0 | 37.0 |
| Intake man. temp., F..... | 134 | 143 | 128 | 132 | 135 |

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Mazda Rotary
Fuel..... 7602

| Test Number..... | 127 | 128 | 129 | 130 |
|---|---|---|---|---|
| Test Date..... | 3/18/76 | 3/18/76 | 3/18/76 | 3/18/76 |
| Barometer, mm Hg..... | 733.6 | 733.6 | 733.6 | 733.6 |
| Humidity, grains/lb..... | 80 | 80 | 80 | 80 |
| Temperature, F..... | 87 | 85 | 86 | 86 |
| Engine speed, rpm..... | 1000 | 1500 | 2000 | 1000 |
| Torque, lb-ft..... | -10.8 | -17.3 | -20.0 | -10.0 |
| Power, bhp*..... | -2.1 | -5.1 | -7.8 | -1.9 |
| Fuel rate, lb/hr..... | 3.6 | 3.6 | 3.5 | 3.5 |
| Ignition timing, deg BTC.... | 5.0 | 6.0 | 11.0 | 5.0 |
| Manifold vacuum, in Hg..... | 16.5 | 19.5 | 20.5 | 16.5 |
| Throttle angle, deg..... | 0.0 | 0.0 | 0.0 | 0.0 |
| Concentrations, dry basis: | | | | |
| CO, %..... | .5982 | .1740 | .1826 | .4655 |
| CO2, %..... | 6.21 | 4.35 | 3.34 | 7.14 |
| O2, %..... | 11.10 | 13.50 | 15.20 | 10.00 |
| HC, ppmC..... | 16100 | 9781 | 14597 | 11423 |
| NOx, ppm..... | 5 | 5 | 4 | 7 |
| Air-fuel ratio..... | 24.50 | 36.10 | 40.20 | 23.81 |
| Emission rates, g/hr: | | | | |
| CO..... | 227.6 | 96.9 | 112.6 | 166.4 |
| HC..... | 308.2 | 274.2 | 453.1 | 205.5 |
| NOx**..... | .3 | .5 | .4 | .4 |
| Oil temperature, F..... | 175 | 173 | 173 | 173 |
| Oil pressure, psi..... | 36 | 57 | 66 | 26 |
| Coolant temperature, F..... | 173 | 173 | 173 | 173 |
| Exhaust temperature, F..... | 1098 | 1140 | 1145 | 1174 |
| Exhaust pressure, in H2O.... | 2.0 | 5.0 | 5.0 | 2.0 |
| Intake man. temp., F..... | 114 | 119 | 144 | 150 |

* Corrected - SAE J816b
** Corrected for humidity.

Engine..... Mazda Rotary
Fuel..... 7602

| Test Number..... | 131 | 132 |
|---|---|---|
| Test Date..... | 3/18/76 | 3/18/76 |
| Barometer, mm Hg..... | 733.6 | 733.6 |
| Humidity, grains/lb..... | 80 | 80 |
| Temperature, F..... | 86 | 87 |
| Engine speed, rpm..... | 1500 | 2000 |
| Torque, lb-ft..... | -16.5 | -18.5 |
| Power, bhp*..... | -4.8 | -7.2 |
| Fuel rate, lb/hr..... | 3.6 | 3.6 |
| Ignition timing, deg BTC.... | 6.0 | 11.0 |
| Manifold vacuum, in Hg..... | 19.5 | 20.5 |
| Throttle angle, deg..... | 0.0 | 0.0 |
| Concentrations, dry basis: | | |
| CO, %..... | .1769 | .1800 |
| CO2, %..... | 4.56 | 3.37 |
| O2, %..... | 13.50 | 15.20 |
| HC, ppmC..... | 10240 | 13156 |
| NOx, ppm..... | 6 | 4 |
| Air-fuel ratio..... | 35.02 | 41.25 |
| Emission rates, g/hr: | | |
| CO..... | 94.8 | 114.2 |
| HC..... | 276.1 | 420.0 |
| NOx**..... | .5 | .5 |
| Oil temperature, F..... | 173 | 175 |
| Oil pressure, psi..... | 41 | 47 |
| Coolant temperature, F..... | 173 | 173 |
| Exhaust temperature, F..... | 1238 | 1153 |
| Exhaust pressure, in H20.... | 5.0 | 5.0 |
| Intake man. temp., F..... | 149 | 171 |

* Corrected - SAE J816b
** Corrected for humidity.