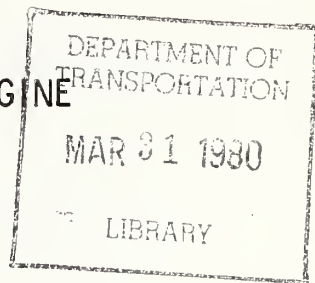


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PERFORMANCE CHARACTERISTICS  
OF 1977 AMERICAN MOTOR S 304 CID ENGINE



Joseph Boziuk

U.S. DEPARTMENT OF TRANSPORTATION  
RESEARCH AND SPECIAL PROGRAMS ADMINISTRATION

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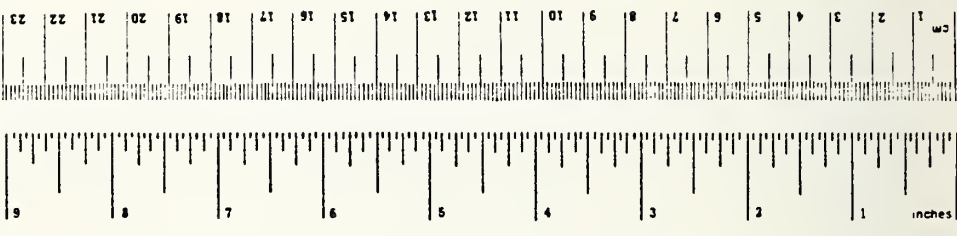
## PREFACE

This report was prepared under PPA HS027, Research and Analysis in Fuel Economy and Related Areas, sponsored by the Technology Assessment Division of the National Highway Traffic Safety Administration. It presents the results of laboratory testing of the 1977 AM 304 CID engine to determine fuel economy and emissions over a sufficient speed-load range to effectively map the engine.

## METRIC CONVERSION FACTORS

| Approximate Conversions to Metric Measures |                            | Approximate Conversions from Metric Measures |                   |
|--|----------------------------|--|-------------------|
| When You Know                              | Multiply by                | When You Know                                | Multiply by       |
| Symbol                                     | To Find                    | Symbol                                       | To Find           |
| <b>LENGTH</b>                              |                            |  |                   |
| inches                                     | 0.025                      | millimeters                                  | 0.04              |
| feet                                       | 30                         | centimeters                                  | 0.4               |
| yards                                      | 0.9                        | meters                                       | 3.3               |
| miles                                      | 1.6                        | kilometers                                   | 1.1               |
| <b>AREA</b>                                |                            |  |                   |
| square inches                              | 6.5                        | square centimeters                           | 0.16              |
| square feet                                | 0.09                       | square meters                                | 1.2               |
| square yards                               | 0.8                        | square kilometers                            | 0.4               |
| square miles                               | 2.6                        | hectares (10,000 m <sup>2</sup> )            | 2.5               |
| acres                                      | 0.4                        |  |                   |
| <b>MASS (weight)</b>                       |                            |  |                   |
| ounces                                     | 28                         | grams  | 0.035             |
| pounds                                     | 0.45                       | kilograms                                    | 2.2               |
| short tons (2000 lb)                       | 0.9                        | tonnes (1000 kg)                             | 1.1               |
| <b>VOLUME</b>                              |                            |  |                   |
| teaspoons                                  | 5                          | milliliters                                  | 0.03              |
| tablespoons                                | 15                         | liters                                       | 2.1               |
| fluid ounces                               | 30                         | quarts                                       | 1.04              |
| cup  | 0.24                       | liters                                       | 0.26              |
| pints                                      | 0.47                       | cubic meters                                 | 35                |
| quarts                                     | 0.95                       | cubic meters                                 | 1.3               |
| gallons                                    | 3.8                        |  |                   |
| cubic feet                                 | 0.03                       |  |                   |
| cubic yards                                | 0.76                       |  |                   |
| <b>TEMPERATURE (exact)</b>                 |                            |  |                   |
| Fahrenheit temperature                     | 5/9 (after subtracting 32) | Celsius temperature                          | 9/5 (then add 32) |

| Symbol                     | Multiply by       | To Find                | Symbol          |
|----------------------------|-------------------|------------------------|-----------------|
| <b>LENGTH</b>              |                   |                        |                 |
| mm                         | 0.04              | inches                 | in              |
| cm                         | 0.4               | inches                 | in              |
| m                          | 3.3               | feet                   | ft              |
| km                         | 1.1               | yards                  | yd              |
|                            | 0.6               | miles                  | mi              |
| <b>AREA</b>                |                   |                        |                 |
| cm <sup>2</sup>            | 0.16              | square inches          | in <sup>2</sup> |
| m <sup>2</sup>             | 1.2               | square yards           | yd <sup>2</sup> |
| km <sup>2</sup>            | 0.4               | square miles           | mi <sup>2</sup> |
| ha                         | 2.5               | acres                  |                 |
| <b>MASS (weight)</b>       |                   |                        |                 |
| g                          | 0.035             | ounces                 | oz              |
| kg                         | 2.2               | pounds                 | lb              |
| t                          | 1.1               | short tons             |                 |
| <b>VOLUME</b>              |                   |                        |                 |
| ml                         | 0.03              | fluid ounces           | fl oz           |
| l                          | 2.1               | pints                  | pt              |
| l                          | 1.04              | quarts                 | qt              |
| l                          | 0.26              | gallons                | gal             |
| m <sup>3</sup>             | 35                | cubic feet             | ft <sup>3</sup> |
| m <sup>3</sup>             | 1.3               | cubic yards            | yd <sup>3</sup> |
| <b>TEMPERATURE (exact)</b> |                   |                        |                 |
| °C                         | 9/5 (then add 32) | Fahrenheit temperature | °F              |



\* 1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Monograph 286, Units of Weight and Measure, Price \$2.25, SD Catalog No. C-11 (1978).

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## 1. INTRODUCTION

The purpose of the study was to obtain engine performance data for estimating fuel economy and emissions for varied engine service and duty. This work supports the data base of the VEHSIM (Vehicle Simulator) Computer program at the Transportation Systems Center (TSC).

The data presented in this report are for an 8-cylinder spark ignition 1977 AM 304 CID engine with a catalytic converter, EGR, manifold pre-heated air inlet system, alternator (driven only, no output) exhaust air injection pump and fan. The engine as equipped is intended for use in a forty-nine state (Federal) vehicle with automatic transmission. The test results present steady-state data sufficient to map the engine for fuel economy and emissions (carbon monoxide, hydrocarbons, and oxides of nitrogen) over the entire operating range of the engine.

## 2. ENGINE TEST REPORT

The engine test set up included a complete mean tolerance engine (SAE definition) coupled to Schenck eddy-current dynamometer capable of absorbing 180 horsepower and 250 lb-ft of torque. The alternator was included but not wired into the engine's electrical system. The engine was also equipped with a catalytic converter, EGR, fan, preheated air inlet system, and exhaust air injection pump.

The manufacturer's specifications for the engine are given in Table 1.

TABLE 1. MANUFACTURER'S ENGINE SPECIFICATIONS

|                    |                        |
|--------------------|------------------------|
| Year               | 1977                   |
| Manufacturer       | American Motors        |
| Displacement       | 304 CID                |
| No. Cylinders      | 8                      |
| Maximum Horsepower | 126 BHP @ 3600 RPM     |
| Maximum Torque     | 219 lb - ft @ 2000 RPM |
| Carburetor         | 2 V                    |
| Bore and Stroke    | 3.75 in. x 3.44 in.    |
| Compression Ratio  | 8.4                    |

Emissions instrumentation consisted of the following Beckman Instruments Corp. instruments.

|                    |                                     |
|--------------------|-------------------------------------|
| CO                 | Model 864 Infrared Analyzer (NDIR)  |
| CO <sub>2</sub>    | Model 864 Infrared Analyzer (NDIR)  |
| NO/NO <sub>x</sub> | Model 951 Chemiluminescent Detector |
| O <sub>2</sub>     | Model F3 Paramagnetic Analyzer      |
| HC                 | Model 402 Flame Ionization Detector |

Prior to testing, the engine break-in consisted of following the schedule shown in Table 2. A single batch of unleaded gasoline was used for break-in and engine testing. The gasoline specifications are shown in Table 3.

TABLE 2. ENGINE BREAK-IN SCHEDULE

| PROGRAM 1:                                | <u>MPH</u> | <u>RPM</u> | <u>DURATION<br/>(MINUTES)</u> |
|---|------------|------------|-------------------------------|
|   | 20         | 830        | 4                             |
|   | 40         | 1701       | 4                             |
|   | 60         | 2552       | 4                             |
|   | 50         | 2126       | 4                             |
|   | 30         | 1276       | 4                             |
| (37 Cycles for an Accumulated 500 Miles)  |            |            |                               |
| PROGRAM 2:                                | <u>MPH</u> | <u>RPM</u> | <u>DURATION<br/>(MINUTES)</u> |
|   | 40         | 1701       | 4                             |
|   | 60         | 2552       | 4                             |
|   | 70         | 2977       | 4                             |
|   | 60         | 2552       | 4                             |
|   | 70         | 2977       | 4                             |
|   | 65         | 2764       | 4                             |
|   | 55         | 2340       | 4                             |
| (36 Cycles for an Accumulated 1500 Miles) |            |            |                               |

TABLE 3. FUEL SPECIFICATIONS

| <u>TYPE</u>                  | <u>AMCO INDOLENE</u> |
|------------------------------|----------------------|
| Specific gravity @ 60°F      | .7316                |
| Percent Carbon               | 85.70                |
| Percent Hydrogen             | 13.62                |
| Hydrogen/Carbon Molar Ratio  | 1.89                 |
| Upper heating value (BTU/lb) | 20,590               |

During the steady-state test, the engine was operated at the following speed-load modes:

| <u>SPEED-RPM</u> | <u>LOADS-TORQUE</u>   |
|------------------|---|
| 595              | 15<br>0<br>0%, 10%, 20%, 30%, 40%, 55%, 70%, 85%, 100% WOT Torque |
| 700              |   |
| 1000             |   |
| 1500             |   |
| 2000             |   |
| 2500             |   |
| 3000             |   |
| 3600             |   |

Each test point was duplicated and the following data were recorded for each:

Ambient Pressure, mm Hg  
Ambient Temperature, °F  
Ambient Relative Humidity, %  
Engine Speed, RPM  
Torque, lb-ft.  
Accumulated Fuel, cc (Fluidyne model 1250)  
Ignition Timing, °BTDC  
Manifold Vacuum, inches Hg  
Throttle Angle, degrees  
Oil Pump Exit Pressure, psi  
Oil Temperature, °F  
Coolant Exit Temperature, °F  
Exhaust Temperature Before Catalyst, °F  
Exhaust Pressure Before Catalyst, inches H<sub>2</sub>O  
Emissions Concentrations After Catalyst, dry basis:  
CO, %  
CO<sub>2</sub>, %  
HC, ppm  
NO<sub>x</sub>, ppm  
Exhaust Temperature After Catalyst, °F.

The following equations were used in calculating corrected torque, corrected horsepower, mass fuel flow rate, corrected brake specific fuel consumption, air-to-fuel ratio based on emissions, mass emission rates of CO, HC, NO<sub>x</sub>, and ambient absolute humidity.

CORRECTED TORQUE,  $T_c$  (lb-ft)<sup>(1)</sup> From SAE J245, Spark Ignition Engine Rating Code, adjusted to standard SAE ambient conditions:

$$T_c = \frac{B_d^*}{B_{dt}} \left( \frac{t_t + A}{t^* + A} \right)^{1/2} T_t$$

where

$B_d^*$  = Standard Dry Barometric Pressure (29.00 in Hg, 97.9 kPa)

$B_{dt}$  = Dry Barometric Pressure at Test Conditions

$t_t$  = Ambient Air Temperature at Test Conditions

$t^*$  = Standard Ambient Temperature (85°F, 29.4°C)

$A$  = Absolute Temperature Constant (460°R, 273°K)

$T_t$  = Measured Torque at Test Conditions.

CORRECTED HORSEPOWER,  $hp_c$ <sup>(1)</sup> From SAE J245, Spark Ignition Engine Rating Code, adjusted to standard SAE ambient conditions:

$$hp_c = \frac{T_c N}{G}$$

where

$T_c$  = Corrected Torque (See Above)

$N$  = Engine Speed (RPM)

$G$  = Power Constant (5252 English, 955 SI).

(1) Engines with manifold preheated air inlet systems are designed to control carburetor air inlet temperature to a specific temperature. Excursions in ambient temperature below this value do not appreciably affect the controlled temperature. The engine performance correction factor as described in SAE J245 Engine Rating Code for Spark Ignition Engines has therefore been updated as follows: If ambient temperature is less than or equal to the manufacturer's stated controlled temperatures, no correction component involving carburetor inlet temperature is made. If ambient temperature exceeds the targeted controlled temperature, the normal J245 correction factor is applied with the targeted controlled temperature used in place of the standard ambient temperature.

MASS FUEL FLOW RATE (lb/hr) From volumetric measurement (corrected to 60°F per ASTM petroleum tables) and fuel specific gravity:

$$\dot{m}_f = \frac{(\text{SpG})_f \left( \frac{1 \text{ lb H}_2\text{O}}{\text{vol}} \right) (\text{vol})_f}{\Delta t_T}$$

where

- $\dot{m}_f$  = Fuel Flow Rate lb/hr
- $(\text{SpG})_f$  = Specific Gravity of Fuel
- $(1 \text{ lb H}_2\text{O}/\text{vol})$  = Pounds of Water per Unit Volume
- $(\text{vol})_f$  = Volume of Fuel Measured, corrected to 60°F per ASTM petroleum tables
- $\Delta t_T$  = Time Interval of Volume Measurement (hrs).

CORRECTED BRAKE SPECIFIC FUEL CONSUMPTION (BSFC) (lb/HP-Hr)

$$\text{BSFC}_c = \frac{\dot{m}_f}{\text{HP}_c}$$

where

- $\text{BSFC}_c$  = Corrected Brake Specific Fuel Consumption
- $\text{HP}_c$  = Corrected Horsepower
- $\dot{m}_f$  = Mass Fuel Flow Rate (lb/hr).

AIR/FUEL RATIO (A/F) Based on emissions measurements from SPINDT, SAE #650507:

$$A/F = F_b \left[ 11.492 F_c \left( \frac{1+R/2+Q}{1+R} \right) + \left( \frac{120(1-FC)}{3.5+R} \right) \right]$$

where

$$R = \frac{\% \text{ CO}}{\% \text{ CO}_2} = \frac{\text{Percent CO Concentration}}{\text{Percent CO}_2 \text{ Concentration}}$$

$$F_c = \text{Mass Fraction of Carbon in Fuel}$$

$$F_b = \frac{\% \text{ CO} + \% \text{ CO}_2}{\% \text{ CO} + \% \text{ CO}_2 + \% \text{ CH}}$$

$$Q = \frac{\% \text{ O}_2}{\% \text{ CO}_2} = \frac{\text{Percent O}_2 \text{ Concentration}}{\text{Percent CO}_2 \text{ Concentration}}$$

CARBON MONOXIDE (CO) MASS EMISSION RATE (Grams/Hr)

$$\text{MASS CO} = (4.383) (\dot{m}_f) (A/F+1) (\% \text{ CO}) \left[ \frac{1}{1 + 0.03148 (\% \text{ CO}_2) \frac{\% \text{ CO} + \% \text{ CO}_2}{\% \text{ CO} + 3\% \text{ CO}_2}} \right]$$

where

- $\dot{m}_f$  = Mass Fuel Flow Rate
- A/F = Air to Fuel Ratio
- % CO = Percent CO Concentration
- % CO<sub>2</sub> = Percent CO<sub>2</sub> Concentration .

HYDROCARBON (HC) MASS EMISSION RATE. (Grams/Hr)

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

where

- $\dot{m}_f$  = Mass Fuel Flow Rate
- A/F = Air to Fuel Ratio
- ppm HC = Parts per Million of HC Concentration.

OXIDES OF NITROGEN (NO<sub>x</sub>) MASS EMISSIONS RATE (Gram/Hr)

$$\text{Mass NO}_x = 0.007201 (\dot{m}_f) (A/F+1) (\text{ppm NO}_x) \left[ \frac{1}{1 + .03148 (\% \text{ CO}_2) \left( \frac{\% \text{ CO} + \% \text{ CO}_2}{\% \text{ CO} + 3\% \text{ CO}_2} \right)} \right]$$

where

- $\dot{m}_f$  = Mass Fuel Flow Rate
- A/F = Air to Fuel Ration
- ppm NO<sub>x</sub> = Parts per Million NO<sub>x</sub> Concentration
- % CO = Percent CO Concentration
- % CO<sub>2</sub> = Percent CO<sub>2</sub> Concentration
- K<sub>H</sub> = Humidity Correction Factor .

HUMIDITY CORRECTION FACTOR

$$K_H = \frac{1}{1 - .0047 (\text{Absolute Humidity} - 75)}$$

where absolute humidity is in grams/pound of dry air.

ABSOLUTE HUMIDITY (AH) (Grains/Lb Dry Air):

$$AH = \frac{(RH) P_{SU}}{1.608 (P_{AMB} - RH \cdot P_{SU})}$$

where

- RH = Measured Relative Humidity
- P<sub>SU</sub> = Saturated Vapor Pressure (from Keenan and Keyes Steam Tables)
- P<sub>AMB</sub> = Ambient Barometric Pressure.

### 3. DISCUSSION OF TEST RESULTS

Appendixes A and B summarize engine map data in tabular and graphical form, respectively. Each test point is repeated once. Fuel consumption, hydrocarbon mass rates, and oxides of nitrogen mass rates demonstrated excellent repeatability. Air-to-fuel rates, however, were not very repeatable below 1600 RPM.



APPENDIX A    TABULAR SUMMARY OF ENGINE MAP DATA

AMC 304 CID

| Engine                     | 2       | 65      | 1       | 64      | 3       | 4       |
|----------------------------|---------|---------|---------|---------|---------|---------|
| Test Number                | 4/16/77 | 4/23/77 | 4/16/77 | 4/23/77 | 4/16/77 | 4/16/77 |
| Test Date                  | 764.3   | 770.5   | 764.3   | 771.1   | 787.7   | 787.4   |
| Barometer, mm Hg           | 20.     | 25.     | 20.     | 28.     | 19.     | 19.     |
| Humidity, grains/lb        | 74.     | 84.     | 73.     | 86.     | 76.     | 76.     |
| Ambient temperature, F     |         |         |         |         |         |         |
| Engine speed, rpm          | 595.    | 595.    | 700.    | 700.    | 1000.   | 1000.   |
| Torque, lb-ft              | 14.9    | 14.4    | 0.1     | 0.1     | 0.0     | 17.5    |
| Power, bhp                 | 1.7     | 1.6     | 0.0     | 0.0     | 0.0     | 3.4     |
| Fuel rate, lb/hr           | 4.5     | 4.4     | 4.2     | 3.7     | 5.4     | 6.5     |
| Ignition timing, deg FIC   | 11.0    | 9.0     | 7.0     | 8.0     | 11.0    | 22.0    |
| Manifold vacuum, in Hg     | -16.3   | -16.5   | -18.1   | -18.3   | -19.6   | -19.1   |
| Throttle angle, deg        | 0.0     | 0.0     | 0.0     | 0.0     | 2.0     | 2.5     |
| Brake specific fuel cons*  | 2.676   | 2.688   | 264.900 | 238.500 | ****    | 1.889   |
| Oil temperature, F         | 153.    | 153.    | 153.    | 154.    | 155.    | 154.    |
| Oil pressure, psi          | 24.     | 25.     | 29.     | 34.     | 38.     | 39.     |
| Coolant temperature, F     | 195.    | 193.    | 196.    | 196.    | 197.    | 196.    |
| Before Catalyst            |         |         |         |         |         |         |
| Exhaust temperature, F     | 438.    | 488.    | 486.    | 570.    | 586.    | 545.    |
| Exhaust pressure, in H2O   | 2.3     | 2.5     | 2.4     | 2.6     | 3.5     | 4.2     |
| After Catalyst             |         |         |         |         |         |         |
| Concentrations, dry basis: |         |         |         |         |         |         |
| CO, %                      | 0.018   | 0.019   | 0.015   | 0.018   | 0.015   | 0.017   |
| CO2, %                     | 11.52   | 11.64   | 10.88   | 10.87   | 10.36   | 11.03   |
| O2, %                      | 4.45    | 4.38    | 5.41    | 5.33    | 6.22    | 5.37    |
| HC, PPM                    | 5.      | 134.    | 14.     | 168.    | 16.     | 12.     |
| NOx, PPM                   | 74.     | 53.     | 59.     | 44.     | 69.     | 140.    |
| Air-fuel ratio             | 18.48   | 18.36   | 19.57   | 19.48   | 20.59   | 19.47   |
| Emission rates, g/hr:      |         |         |         |         |         |         |
| CO                         | 6.      | 6.      | 5.      | 5.      | 7.      | 9.      |
| HC                         | 0.1     | 2.5     | 0.3     | 2.8     | 0.4     | 0.4     |
| NOx**                      | 4.2     | 2.9     | 3.3     | 2.2     | 5.3     | 12.0    |
| Exhaust temperature, F     | 789.    | 840.    | 722.    | 763.    | 746.    | 812.    |

\* Corrected - SAE J245 Spark ignition engine rating code

\*\* Corrected for humidity

AMC 304 CID

| Engine                     | 5       | 6       | 7       | 8       | 9       | 10      |
|----------------------------|---------|---------|---------|---------|---------|---------|
| Test Number                | 4/16/77 | 4/16/77 | 4/16/77 | 4/16/77 | 4/16/77 | 4/16/77 |
| Test Date                  |         |         |         |         |         |         |
| Barometer, mm Hg           | 762.0   | 762.3   | 787.4   | 764.3   | 787.4   | 787.4   |
| Humidity, grains/lb        | 20.     | 20.     | 19.     | 21.     | 21.     | 22.     |
| Ambient temperature, F     | 77.     | 77.     | 78.     | 82.     | 84.     | 85.     |
| Engine speed, rpm          | 1000.   | 1000.   | 1000.   | 1000.   | 1000.   | 1000.   |
| Torque, lb-ft              | 37.3    | 57.6    | 69.6    | 102.1   | 126.9   | 153.6   |
| Power, bhp                 | 7.1     | 11.0    | 13.2    | 19.5    | 24.2    | 29.3    |
| Fuel rate, lb/hr           | 8.1     | 9.5     | 11.3    | 15.4    | 17.9    | 22.7    |
| Ignition timing, deg BTC   | 26.0    | 37.0    | 28.0    | 19.0    | 18.0    | 17.0    |
| Manifold vacuum, in Hg     | -14.1   | -10.5   | -7.0    | -2.3    | -2.0    | -1.7    |
| Throttle angle, deg        | 4.5     | 6.5     | 9.5     | 19.5    | 23.5    | 28.0    |
| Brake specific fuel cons*  | 1.142   | 0.864   | 0.859   | 0.789   | 0.742   | 0.774   |
| Oil temperature, F         | 155.    | 155.    | 155.    | 157.    | 159.    | 160.    |
| Cil pressure, psi          | 39.     | 38.     | 37.     | 35.     | 33.     | 32.     |
| Coolant temperature, F     | 198.    | 195.    | 199.    | 200.    | 200.    | 200.    |
| Before Catalyst            |         |         |         |         |         |         |
| Exhaust temperature, F     | 634.    | 695.    | 796.    | 913.    | 921.    | 913.    |
| Exhaust pressure, in H2O   | 6.2     | 7.8     | 11.1    | 19.7    | 24.1    | 29.2    |
| After Catalyst             |         |         |         |         |         |         |
| Concentrations, dry basis: |         |         |         |         |         |         |
| CO, %                      | 0.015   | 0.018   | 0.014   | 0.103   | 1.331   | 1.488   |
| CO2, %                     | 11.58   | 11.62   | 12.15   | 14.39   | 13.84   | 10.34   |
| O2, %                      | 4.56    | 4.46    | 3.64    | 0.25    | 0.00    | 0.00    |
| HC, ppm                    | 11.     | 11.     | 1.      | 3.      | 15.     | 21.     |
| NOx, ppm                   | 105.    | 184.    | 200.    | 65.     | 46.     | 54.     |
| Air-fuel ratio             | 18.56   | 18.45   | 17.62   | 14.80   | 14.06   | 13.80   |
| Emission rates, g/ht:      |         |         |         |         |         |         |
| CO                         | 9.      | 13.     | 12.     | 95.     | 1364.   | 1959.   |
| HC                         | 0.4     | 0.5     | 0.1     | 0.2     | 0.9     | 1.5     |
| NOx**                      | 10.7    | 21.7    | 27.0    | 10.0    | 7.7     | 11.7    |
| Exhaust temperature, F     | 788.    | 765.    | 851.    | 1319.   | 1357.   | 1306.   |

\* Corrected - SAE J245 Spark ignition engine rating code

\*\* Corrected for humidity

AMC 304 CID

| Engine                     | 11      | 66      | 67      | 68      | 69      | 70      |
|----------------------------|---------|---------|---------|---------|---------|---------|
| Test Number                | 4/16/77 | 4/23/77 | 4/23/77 | 4/23/77 | 4/23/77 | 4/23/77 |
| Barometer, mm Hg           | 787.4   | 770.9   | 770.9   | 770.9   | 770.6   | 770.6   |
| Humidity, grains/lb        | 22.     | 35.     | 36.     | 35.     | 38.     | 38.     |
| Ambient temperature, F     | 86.     | 87.     | 87.     | 86.     | 84.     | 85.     |
| Engine speed, rpm          | 1000.   | 1000.   | 1000.   | 1000.   | 1000.   | 1000.   |
| Torque, lb-ft              | 162.3   | 0.7     | 17.7    | 37.1    | 55.8    | 71.7    |
| Power, bhp                 | 30.8    | 0.1     | 3.3     | 7.1     | 10.6    | 13.6    |
| Fuel rate, lb/hr           | 26.4    | 5.6     | 6.1     | 8.0     | 9.4     | 11.4    |
| Ignition timing, deg ETC   | 13.0    | 11.0    | 20.0    | 23.0    | 33.0    | 24.0    |
| Manifold vacuum, in Hg     | -0.3    | -20.0   | -19.3   | -14.1   | -11.5   | -7.1    |
| Throttle angle, deg        | 65.0    | 2.0     | 3.0     | 5.0     | 6.5     | 5.5     |
| Brake specific fuel ccns   | 0.858   | 44.680  | 1.837   | 1.128   | 0.885   | 0.836   |
| Oil temperature, F         | 160.    | 152.    | 152.    | 153.    | 154.    | 155.    |
| Oil pressure, psi          | 31.     | 45.     | 44.     | 44.     | 43.     | 44.     |
| Coolant temperature, F     | 199.    | 197.    | 195.    | 198.    | 199.    | 200.    |
| Before Catalyst            |         |         |         |         |         |         |
| Exhaust temperature, F     | 874.    | 650.    | 618.    | 708.    | 753.    | 861.    |
| Exhaust pressure, in H2O   | 33.3    | 3.5     | 4.0     | 6.5     | 8.1     | 12.0    |
| After Catalyst             |         |         |         |         |         |         |
| Concentrations, dry basis: |         |         |         |         |         |         |
| CO, %                      | 1.388   | 0.018   | 0.015   | 0.019   | 0.021   | 0.024   |
| CO2, %                     | 8.54    | 10.38   | 10.69   | 11.33   | 11.54   | 12.26   |
| O2, %                      | 0.00    | 6.15    | 5.70    | 4.75    | 4.32    | 3.34    |
| HC, ppmC                   | 22.     | 125.    | 122.    | 124.    | 103.    | 116.    |
| NOx, ppm                   | 31.     | 61.     | 93.     | 85.     | 121.    | 139.    |
| Air-fuel ratio             | 13.68   | 20.52   | 19.91   | 18.78   | 18.33   | 17.33   |
| Emission rates, q/hr:      |         |         |         |         |         |         |
| CO                         | 2144.   | 5.      | 8.      | 12.     | 15.     | 19.     |
| HC                         | 1.8     | 3.3     | 3.4     | 4.3     | 4.1     | 5.4     |
| NOx**                      | 7.7     | 4.8     | 7.7     | 8.6     | 14.1    | 16.4    |
| Exhaust temperature, F     | 1276.   | 735.    | 767.    | 791.    | 801.    | 902.    |

\* Corrected - SAB J245 Spark ignition engine rating code  
 \*\* Corrected for humidity

AMC 304 CID

| Engine                     | 71      | 73      | 74      | 75      | 12      | 13      |
|----------------------------|---------|---------|---------|---------|---------|---------|
| Test Number                | 4/23/77 | 4/25/77 | 4/25/77 | 4/25/77 | 4/16/77 | 4/16/77 |
| Barometer, mm Hg           | 770.6   | 758.4   | 759.0   | 758.7   | 764.0   | 763.8   |
| Humidity, grains/lb        | 40.     | 38.     | 37.     | 37.     | 22.     | 22.     |
| Ambient temperature, F     | 87.     | 80.     | 82.     | 85.     | 85.     | 85.     |
| Engine speed, rpm          | 1000.   | 1000.   | 1000.   | 1000.   | 1500.   | 1500.   |
| Torque, lb-ft*             | 100.8   | 132.7   | 159.8   | 172.7   | 1.6     | 18.2    |
| Power, bhp*                | 19.0    | 25.1    | 30.4    | 32.7    | 0.4     | 5.2     |
| Fuel rate, lb/hr           | 16.0    | 18.6    | 23.9    | 26.4    | 8.1     | 9.8     |
| Ignition timing, deg BTC   | 17.0    | 13.0    | 12.0    | 9.5     | 30.0    | 30.0    |
| Manifold vacuum, in Hg     | -2.3    | -2.0    | -1.7    | -0.3    | -18.9   | -16.4   |
| Throttle angle, deg        | 19.5    | 24.0    | 29.0    | 75.0    | 5.0     | 7.0     |
| Brake specific fuel cons*  | 0.840   | 0.740   | 0.786   | 0.807   | 19.070  | 1.895   |
| Oil temperature, F         | 155.    | 157.    | 157.    | 159.    | 156.    | 158.    |
| Oil pressure, psi          | 42.     | 39.     | 38.     | 36.     | 49.     | 48.     |
| Coolant temperature, F     | 199.    | 200.    | 198.    | 199.    | 198.    | 199.    |
| Before Catalyst            |         |         |         |         |         |         |
| Exhaust temperature, F     | 1015.   | 1031.   | 961.    | 578.    | 724.    | 767.    |
| Exhaust pressure, in H2O   | 20.7    | 25.2    | 30.8    | 34.8    | 7.4     | 5.9     |
| After Catalyst             |         |         |         |         |         |         |
| Concentrations, dry basis: |         |         |         |         |         |         |
| CO, %                      | 0.693   | 3.426   | 1.349   | 1.370   | 0.014   | 0.045   |
| CO2, %                     | 14.11   | 12.58   | 9.03    | 8.55    | 10.10   | 10.67   |
| O2, %                      | 0.00    | 0.00    | 0.00    | 0.00    | 6.57    | 5.81    |
| HC, ppmC                   | 138.    | 12.     | 6.      | 14.     | 16.     | 8.      |
| NOx, ppm                   | 44.     | 91.     | 74.     | 62.     | 75.     | 115.    |
| Air-fuel ratio             | 14.36   | 13.24   | 13.82   | 13.74   | 21.08   | 20.01   |
| Emission rates, g/hr:      |         |         |         |         |         |         |
| CO                         | 646.    | 3447.   | 1899.   | 2127.   | 10.     | 37.     |
| HC                         | 7.4     | 0.7     | 0.5     | 1.2     | 0.6     | 0.4     |
| NOx**                      | 6.7     | 15.1    | 17.2    | 15.7    | 8.7     | 15.9    |
| Exhaust temperature, F     | 1354.   | 1333.   | 1295.   | 1274.   | 763.    | 758.    |

\* Corrected - SAE J245 Spark ignition engine rating code

\*\* Corrected for humidity



| Engine                     | 14                         | 15      | 17      | 18      | 19      | 20      |
|----------------------------|----------------------------|---------|---------|---------|---------|---------|
| Test Number                | 4/16/77                    | 4/16/77 | 4/18/77 | 4/18/77 | 4/18/77 | 4/18/77 |
| Test Date                  | 763.5                      | 763.5   | 768.9   | 769.1   | 769.1   | 769.1   |
| Barometer, mm Hg           | 22.                        | 23.     | 29.     | 31.     | 31.     | 30.     |
| Humidity, grains/lb.       | 86.                        | 86.     | 81.     | 87.     | 90.     | 91.     |
| Ambient temperature, F     | 1500.                      | 1500.   | 1500.   | 1500.   | 1500.   | 1500.   |
| Engine speed, rpm          | 36.8                       | 55.4    | 73.3    | 100.1   | 127.7   | 154.7   |
| Torque, lb-ft*             | 10.5                       | 15.5    | 20.9    | 28.6    | 36.5    | 44.2    |
| Power, bhp*                | 11.7                       | 13.4    | 15.3    | 23.7    | 27.1    | 31.9    |
| Fuel rate, lb/hr.          | 30.0                       | 30.0    | 19.5    | 14.0    | 21.0    | 8.0     |
| Ignition timing, deg ETC.  | -14.0                      | -11.9   | -9.2    | -3.4    | -2.2    | -1.9    |
| Manifold vacuum, in Hg     | 8.5                        | 10.0    | 11.5    | 23.0    | 30.0    | 35.0    |
| Throttle angle, deg        | 1.119                      | 0.841   | 0.731   | 0.829   | 0.743   | 0.722   |
| Brake specific fuel ccns*  | 158.                       | 160.    | 160.    | 164.    | 166.    | 165.    |
| Oil temperature, F         | 48.                        | 48.     | 47.     | 47.     | 47.     | 46.     |
| Oil pressure, psi          | 198.                       | 200.    | 200.    | 201.    | 201.    | 201.    |
| Coolant temperature, F     | 803.                       | 835.    | 901.    | 1215.   | 1178.   | 1095.   |
| Exhaust temperature, F     | 12.8                       | 15.6    | 21.0    | 37.8    | 44.4    | 52.9    |
| Exhaust pressure, in H2O   | After Catalyst             |         |         |         |         |         |
| Concentrations, dry basis: | Concentrations, dry basis: |         |         |         |         |         |
| CO, %                      | 0.015                      | 0.017   | 0.015   | 2.108   | 3.890   | 1.402   |
| CO2, %                     | 11.12                      | 11.51   | 12.05   | 13.40   | 12.27   | 10.64   |
| O2, %                      | 5.23                       | 4.62    | 3.68    | 0.00    | 0.00    | 0.00    |
| HC, ppmC                   | 10.                        | 10.     | 0.      | 20.     | 8.      | 21.     |
| NOx, ppm                   | 182.                       | 279.    | 296.    | 45.     | 73.     | 76.     |
| Air-fuel ratio             | 19.30                      | 18.62   | 17.68   | 13.73   | 13.07   | 13.86   |
| Emission rates, g/hr:      | Emission rates, g/hr:      |         |         |         |         |         |
| CO                         | 14.                        | 17.     | 17.     | 2792.   | 5637.   | 2598.   |
| HC                         | 0.5                        | 0.5     | 0.0     | 1.5     | 0.7     | 2.2     |
| NOx**                      | 28.0                       | 47.0    | 54.0    | 9.8     | 17.4    | 23.2    |
| Exhaust temperature, F     | 834.                       | 872.    | 951.    | 1342.   | 1331.   | 1314.   |

\* Corrected - SAE J245 Spark ignition engine rating code

\*\* Corrected for humidity

AMC 304 CID

| Engine                                | 21      | 76      | 77      | 78      | 79      | 81      |
|---------------------------------------|---------|---------|---------|---------|---------|---------|
| Test Number                           | 4/18/77 | 4/25/77 | 4/25/77 | 4/25/77 | 4/25/77 | 4/26/77 |
| Barometer, mm Hg                      | 769.1   | 757.7   | 757.7   | 757.7   | 757.7   | 759.7   |
| Humidity, grains/lb                   | 31.     | 34.     | 35.     | 35.     | 36.     | 40.     |
| Ambient temperature, F                | 95.     | 81.     | 82.     | 83.     | 85.     | 78.     |
| Engine speed, rpm                     | 1500.   | 1500.   | 1500.   | 1500.   | 1500.   | 1500.   |
| Torque, lb-ft*                        | 186.9   | 0.2     | 18.3    | 36.5    | 54.6    | 73.6    |
| Power, bhp*                           | 53.4    | 0.0     | 5.2     | 10.4    | 15.6    | 21.0    |
| Fuel rate, lb/hr                      | 38.5    | 7.8     | 9.7     | 11.0    | 12.8    | 15.3    |
| Ignition timing, deg BIC              | 19.0    | 29.0    | 30.0    | 30.0    | 30.0    | 25.0    |
| Manifold vacuum, in Hg                | -0.7    | -19.7   | -17.0   | -14.6   | -12.5   | -9.6    |
| Throttle angle, deg                   | 74.5    | 5.0     | 7.0     | 8.5     | 10.5    | 12.0    |
| Brake specific fuel cons*             | 0.721   | 193.600 | 1.853   | 1.054   | 0.825   | 0.729   |
| Oil temperature, F                    | 172.    | 153.    | 155.    | 155.    | 157.    | 154.    |
| Oil pressure, psi                     | 45.     | 45.     | 44.     | 45.     | 44.     | 45.     |
| Coolant temperature, F                | 201.    | 197.    | 198.    | 198.    | 198.    | 199.    |
| Before Catalyst                       |         |         |         |         |         |         |
| Exhaust temperature, F                | 1049.   | 777.    | 833.    | 868.    | 898.    | 957.    |
| Exhaust pressure, in H <sub>2</sub> O | 65.0    | 7.5     | 10.1    | 13.0    | 15.8    | 20.0    |
| After Catalyst                        |         |         |         |         |         |         |
| Concentrations, dry basis:            |         |         |         |         |         |         |
| CO, %                                 | 1.354   | 0.022   | 0.019   | 0.015   | 0.020   | 0.022   |
| CO <sub>2</sub> , %                   | 9.30    | 10.08   | 10.68   | 11.01   | 11.46   | 11.89   |
| O <sub>2</sub> , %                    | 0.00    | 6.65    | 5.82    | 5.31    | 4.68    | 3.95    |
| HC, ppmC                              | 50.     | 3.      | 1.      | 9.      | 13.     | 0.      |
| NOx, ppm                              | 91.     | 64.     | 101.    | 152.    | 233.    | 278.    |
| Air-fuel ratio                        | 13.78   | 21.17   | 20.04   | 19.42   | 18.69   | 17.94   |
| Emission rates, q/hr:                 |         |         |         |         |         |         |
| CO                                    | 3050.   | 15.     | 15.     | 14.     | 20.     | 25.     |
| HC                                    | 6.3     | 0.1     | 0.1     | 0.5     | 0.7     | 0.0     |
| NOx**                                 | 33.9    | 7.2     | 13.3    | 22.0    | 37.7    | 51.3    |
| Exhaust temperature, F                | 1282.   | 786.    | 815.    | 841.    | 876.    | 938.    |

\* Corrected - SAE J245 Spark ignition engine rating code

\*\* Corrected for humidity

AMC 304 CID

| Engine                     | 82                         | 83      | 84      | 85      | 22      | 23      |
|----------------------------|----------------------------|---------|---------|---------|---------|---------|
| Test Number                | 4/26/77                    | 4/26/77 | 4/26/77 | 4/26/77 | 4/18/77 | 4/18/77 |
| Test Date                  | 759.7                      | 761.0   | 761.5   | 762.3   | 766.6   | 766.3   |
| Barometer, mm Hg           | 43.                        | 43.     | 44.     | 45.     | 28.     | 28.     |
| Humidity, grains/lb        | 86.                        | 90.     | 92.     | 97.     | 85.     | 87.     |
| Ambient temperature, F     | 1500.                      | 1500.   | 1500.   | 1500.   | 2000.   | 2000.   |
| Engine speed, rpm          | 101.7                      | 128.8   | 156.9   | 194.7   | 1.1     | 21.0    |
| Torque, lb-ft              | 29.0                       | 36.9    | 44.9    | 56.0    | 0.4     | 8.0     |
| Power, bhp                 | 22.3                       | 28.5    | 32.2    | 39.3    | 11.1    | 13.7    |
| Fuel rate, lb/hr           | 18.5                       | 19.0    | 25.0    | 22.0    | 34.0    | 34.0    |
| Ignition timing, deg FIC   | -4.0                       | -2.3    | -2.0    | -0.7    | -18.2   | -15.9   |
| Manifold vacuum, in Hg     | 21.5                       | 31.5    | 34.0    | 75.0    | 7.0     | 5.0     |
| Throttle angle, deg        | 0.769                      | 0.771   | 0.719   | 0.701   | 35.050  | 1.724   |
| Brake specific fuel cons*  | 158.                       | 160.    | 162.    | 165.    | 157.    | 158.    |
| Oil temperature, F         | 44.                        | 43.     | 44.     | 43.     | 50.     | 49.     |
| Oil pressure, psi          | 198.                       | 199.    | 200.    | 200.    | 200.    | 199.    |
| Coolant temperature, F     | 1293.                      | 1239.   | 1145.   | 1086.   | 858.    | 897.    |
| Exhaust temperature, F     | 36.0                       | 43.3    | 52.5    | 66.0    | 14.7    | 19.5    |
| Exhaust pressure, in H2O   | After Catalyst             |         |         |         |         |         |
| Concentrations, dry basis: | Concentrations, dry basis: |         |         |         |         |         |
| CO, %                      | 0.739                      | 1.364   | 1.204   | 1.405   | 0.006   | 0.013   |
| CO2, %                     | 14.21                      | 11.95   | 10.09   | 8.91    | 10.07   | 10.88   |
| O2, %                      | 0.00                       | 0.00    | 0.00    | 0.00    | 6.62    | 5.58    |
| HC, ppmC                   | 2.                         | 12.     | 915.    | 1442.   | 0.      | 32.     |
| NOx, ppm                   | 67.                        | 85.     | 84.     | 109.    | 93.     | 158.    |
| Air-fuel ratio             | 14.33                      | 13.94   | 13.82   | 13.59   | 21.16   | 19.73   |
| Emission rates, g/hr:      | Emission rates, g/hr:      |         |         |         |         |         |
| CO                         | 958.                       | 2240.   | 2263.   | 3198.   | 6.      | 15.     |
| HC                         | 0.2                        | 1.1     | 96.4    | 182.2   | 0.0     | 2.0     |
| NOx**                      | 14.4                       | 22.8    | 26.0    | 40.6    | 14.9    | 29.0    |
| Exhaust temperature, F     | 1354.                      | 1325.   | 1314.   | 1270.   | 865.    | 912.    |

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AMC 304 CID

| Engine                                | 24      | 25      | 27      | 28      | 29      | 30      |
|---------------------------------------|---------|---------|---------|---------|---------|---------|
| Test Number                           | 4/18/77 | 4/18/77 | 4/20/77 | 4/20/77 | 4/20/77 | 4/20/77 |
| Barometer, in Hg                      | 766.6   | 766.6   | 775.2   | 775.2   | 775.7   | 775.2   |
| Humidity, grains/lb                   | 29.     | 29.     | 42.     | 44.     | 44.     | 42.     |
| Ambient temperature, F                | 88.     | 85.     | 84.     | 91.     | 96.     | 97.     |
| Engine speed, rpm                     | 2000.   | 2000.   | 2000.   | 2000.   | 2000.   | 2000.   |
| Torque, lb-ft*                        | 38.4    | 56.8    | 77.8    | 105.6   | 134.2   | 162.0   |
| Power, bhp*                           | 14.6    | 21.6    | 29.5    | 40.1    | 51.0    | 61.6    |
| Fuel rate, lb/hr                      | 15.7    | 18.1    | 21.6    | 30.9    | 37.6    | 42.5    |
| Ignition timing, deg BIC              | 34.0    | 33.5    | 29.0    | 21.5    | 25.5    | 23.0    |
| Manifold vacuum, in Hg                | -13.9   | -11.6   | -9.1    | -3.8    | -2.4    | -2.0    |
| Throttle angle, deg                   | 11.5    | 13.5    | 17.5    | 28.5    | 37.0    | 43.3    |
| Brake specific fuel cons*             | 1.073   | 0.839   | 0.731   | 0.771   | 0.738   | 0.650   |
| Oil temperature, F                    | 160.    | 162.    | 165.    | 173.    | 178.    | 181.    |
| Oil pressure, psi                     | 49.     | 48.     | 47.     | 46.     | 46.     | 44.     |
| Coolant temperature, F                | 201.    | 201.    | 201.    | 202.    | 201.    | 202.    |
| Before Catalyst                       |         |         |         |         |         |         |
| Exhaust temperature, F                | 929.    | 964.    | 1039.   | 1295.   | 1128.   | 1095.   |
| Exhaust pressure, in H <sub>2</sub> O | 24.0    | 29.5    | 38.0    | 59.6    | 69.4    | 78.0    |
| After catalyst                        |         |         |         |         |         |         |
| Concentrations, dry basis:            |         |         |         |         |         |         |
| CO, %                                 | 0.021   | 0.018   | 0.016   | 2.363   | 1.478   | 1.269   |
| CO <sub>2</sub> , %                   | 11.19   | 11.64   | 12.47   | 13.14   | 10.56   | 10.00   |
| O <sub>2</sub> , %                    | 4.88    | 4.37    | 2.93    | 0.00    | 0.00    | 0.00    |
| HC, ppm                               | 10.     | 14.     | 24.     | 21.     | 30.     | 53.     |
| NOx, ppm                              | 239.    | 356.    | 403.    | 98.     | 95.     | 147.    |
| Air-fuel ratio                        | 18.96   | 18.37   | 16.98   | 13.67   | 13.87   | 13.93   |
| Emission rates, g/hr:                 |         |         |         |         |         |         |
| CO                                    | 25.     | 25.     | 24.     | 4074.   | 3233.   | 3170.   |
| HC                                    | 0.7     | 1.1     | 2.0     | 2.1     | 3.8     | 7.4     |
| NOx**                                 | 48.2    | 80.3    | 99.5    | 27.7    | 34.1    | 60.3    |
| Exhaust temperature, F                | 946.    | 985.    | 1091.   | 1349.   | 1291.   | 1225.   |

\* Corrected - SAE J245 Spark ignition engine rating code

\*\* Corrected for humidity

AMC 304 CID

| Engine.....                 | 31      | 33      | 86      | 87      | 89      | 50      |
|-----------------------------|---------|---------|---------|---------|---------|---------|
| Test Number.....            | 4/20/77 | 4/21/77 | 4/26/77 | 4/26/77 | 4/27/77 | 4/27/77 |
| Test Date.....              | 775.2   | 775.0   | 761.0   | 761.0   | 762.0   | 762.0   |
| Barometer, mm Hg.....       | 43.     | 49.     | 40.     | 39.     | 45.     | 45.     |
| Humidity, grains/lb.....    | 98.     | 54.     | 93.     | 92.     | 84.     | 86.     |
| Ambient temperature, F....  |         |         |         |         |         |         |
| Engine speed, rpm.....      | 2000.   | 2000.   | 2000.   | 2000.   | 2000.   | 2000.   |
| Torque, lb-ft*.....         | 191.5   | 196.9   | 0.0     | 17.5    | 40.0    | 58.7    |
| Power, bhp*.....            | 72.9    | 75.0    | 0.0     | 6.7     | 15.2    | 22.3    |
| Fuel rate, lb/hr.....       | 47.0    | 49.9    | 10.7    | 13.1    | 15.6    | 17.8    |
| Ignition timing, deg ETC..  | 19.0    | 19.5    | 32.0    | 32.0    | 33.0    | 33.0    |
| Manifold vacuum, in Hg....  | -1.4    | -1.1    | -18.4   | -16.3   | -14.1   | -12.0   |
| Throttle angle, deg.....    | 54.5    | 75.0    | 7.0     | 10.0    | 12.0    | 14.5    |
| Brake specific fuel ccns*.. | 0.645   | 0.665   | *****   | 1.963   | 1.026   | 0.795   |
| Oil temperature, F.....     | 191.    | 186.    | 158.    | 158.    | 156.    | 157.    |
| Oil pressure, psi.....      | 44.     | 46.     | 51.     | 47.     | 47.     | 46.     |
| Coolant temperature, F..... | 203.    | 202.    | 197.    | 198.    | 199.    | 195.    |
| Before Catalyst             |         |         |         |         |         |         |
| Exhaust temperature, F....  | 1123.   | 1113.   | 918.    | 954.    | 985.    | 1016.   |
| Exhaust pressure, in H2O..  | 87.3    | 89.6    | 13.8    | 17.7    | 22.7    | 27.8    |
| After Catalyst              |         |         |         |         |         |         |
| Concentrations, dry basis:  |         |         |         |         |         |         |
| CO, %.....                  | 1.393   | 1.413   | 0.025   | 0.019   | 0.020   | 0.015   |
| CO2, %.....                 | 10.40   | 9.67    | 10.26   | 10.85   | 11.33   | 11.81   |
| O2, %.....                  | 0.00    | 0.00    | 6.38    | 5.57    | 4.73    | 4.15    |
| HC, PpmC.....               | 55.     | 57.     | 42.     | 28.     | 34.     | 31.     |
| NOx, Ppm.....               | 450.    | 234.    | 82.     | 127.    | 215.    | 324.    |
| Air-fuel ratio.....         | 13.89   | 13.80   | 20.78   | 19.72   | 18.77   | 18.13   |
| Emission rates, g/hr:       |         |         |         |         |         |         |
| CO.....                     | 3821.   | 4115.   | 23.     | 20.     | 24.     | 20.     |
| HC.....                     | 8.5     | 9.4     | 2.1     | 1.7     | 2.3     | 2.3     |
| NOx**.....                  | 203.0   | 111.8   | 12.4    | 22.3    | 42.6    | 70.5    |
| Exhaust temperature, F....  | 1157.   | 1135.   | 878.    | 917.    | 952.    | 988.    |

\* Corrected - SAE J245 Spark ignition engine rating code

\*\* Corrected for humidity

AMC 304 CID

| Engine                                | 91      | 92      | 93      | 94      | 95      | 34      |
|---------------------------------------|---------|---------|---------|---------|---------|---------|
| Test Number                           | 4/27/77 | 4/27/77 | 4/27/77 | 4/27/77 | 4/27/77 | 4/21/77 |
| Barometer, mm Hg                      | 762.3   | 763.3   | 763.5   | 763.0   | 762.8   | 774.7   |
| Humidity, grains/lb                   | 44.     | 47.     | 47.     | 45.     | 45.     | 67.     |
| Ambient temperature, F                | 89.     | 95.     | 97.     | 98.     | 98.     | 105.    |
| Engine speed, rpm                     | 2000.   | 2000.   | 2000.   | 2000.   | 2000.   | 2500.   |
| Torque, lb-ft*                        | 78.6    | 107.7   | 135.6   | 164.9   | 201.3   | 3.7     |
| Power, bhp*                           | 29.9    | 41.0    | 51.6    | 62.8    | 76.7    | 1.8     |
| Fuel rate, lb/hr                      | 21.0    | 31.5    | 38.2    | 43.2    | 49.5    | 14.4    |
| Ignition timing, deg FIC              | 30.0    | 19.0    | 20.0    | 18.5    | 19.0    | 36.0    |
| Manifold vacuum, in Hg                | -9.4    | -3.6    | -2.4    | -2.0    | -1.1    | -18.1   |
| Throttle angle, deg                   | 16.5    | 30.0    | 38.0    | 43.5    | 75.0    | 10.0    |
| Brake specific fuel cons*             | 0.700   | 0.777   | 0.741   | 0.687   | 0.646   | 0.458   |
| Cil temperature, F                    | 160.    | 164.    | 165.    | 168.    | 172.    | 162.    |
| Cil pressure, psi                     | 46.     | 45.     | 46.     | 44.     | 44.     | 50.     |
| Coolant temperature, F                | 201.    | 201.    | 200.    | 201.    | 201.    | 200.    |
| Before Catalyst                       |         |         |         |         |         |         |
| Exhaust temperature, F                | 1087.   | 1364.   | 1182.   | 1143.   | 1160.   | 943.    |
| Exhaust Pressure, in H <sub>2</sub> O | 35.7    | 59.0    | 69.3    | 77.3    | 88.6    | 21.9    |
| After Catalyst                        |         |         |         |         |         |         |
| Concentrations, dry basis:            |         |         |         |         |         |         |
| CO, %                                 | 0.018   | 3.331   | 1.448   | 1.415   | 1.430   | 0.016   |
| CO <sub>2</sub> , %                   | 12.63   | 12.91   | 10.20   | 5.74    | 9.84    | 10.70   |
| O <sub>2</sub> , %                    | 2.93    | 0.00    | 0.00    | 0.00    | 0.00    | 5.62    |
| HC, ppmC                              | 15.     | 273.    | 954.    | 1357.   | 1571.   | 18.     |
| NOx, ppm                              | 354.    | 90.     | 101.    | 139.    | 268.    | 155.    |
| Air-fuel ratio                        | 16.95   | 13.22   | 13.74   | 13.66   | 13.64   | 19.84   |
| Emission rates, q/hr:                 |         |         |         |         |         |         |
| CO                                    | 26.     | 5719.   | 3203.   | 3530.   | 4082.   | 15.     |
| HC                                    | 1.3     | 27.3    | 118.7   | 189.5   | 251.3   | 1.2     |
| NOx**                                 | 84.5    | 25.3    | 36.6    | 57.1    | 125.5   | 30.1    |
| Exhaust temperature, F                | 1084.   | 1336.   | 1293.   | 1221.   | 1140.   | 943.    |

\* Corrected - SAE J245 Spark ignition engine rating code

\*\* Corrected for humidity

AMC 304 CID

| Engine.....                 | 35      | 36      | 37      | 38      | 39      | 40      |
|-----------------------------|---------|---------|---------|---------|---------|---------|
| Test Number.....            | 35      | 36      | 37      | 38      | 39      | 40      |
| Test Date.....              | 4/21/77 | 4/26/77 | 4/21/77 | 4/21/77 | 4/21/77 | 4/21/77 |
| Barometer, mm Hg.....       | 774.7   | 761.0   | 773.7   | 773.7   | 773.7   | 773.7   |
| Humidity, grains/lb.....    | 42.     | 40.     | 44.     | 47.     | 50.     | 50.     |
| Ambient temperature, F..... | 91.     | 94.     | 99.     | 101.    | 105.    | 106.    |
| Engine speed, rpm.....      | 2500.   | 2500.   | 2500.   | 2500.   | 2500.   | 2500.   |
| Torque, lb-ft*.....         | 18.2    | 36.9    | 55.7    | 75.1    | 102.8   | 132.6   |
| Power, bhp*.....            | 8.7     | 17.6    | 26.5    | 35.7    | 48.9    | 63.0    |
| Fuel rate, lb/hr.....       | 17.0    | 19.1    | 22.4    | 26.3    | 35.9    | 43.5    |
| Ignition timing, deg ETC..  | 36.0    | 36.0    | 36.0    | 32.0    | 21.5    | 21.5    |
| Manifold vacuum, in Hg....  | -16.3   | -14.5   | -12.0   | -9.5    | -4.4    | -2.5    |
| Throttle angle, deg.....    | 11.5    | 15.0    | 16.5    | 20.0    | 33.0    | 43.5    |
| Brake specific fuel ccns*.. | 1.967   | 1.086   | 0.846   | 0.736   | 0.733   | 0.697   |
| Oil temperature, F.....     | 167.    | 166.    | 182.    | 184.    | 192.    | 195.    |
| Oil pressure, psi.....      | 50.     | 47.     | 48.     | 47.     | 49.     | 46.     |
| Coolant temperature, F..... | 201.    | 200.    | 202.    | 203.    | 204.    | 204.    |
| Before Catalyst             |         |         |         |         |         |         |
| Exhaust temperature, F....  | 979.    | 1070.   | 1073.   | 1142.   | 1225.   | 1155.   |
| Exhaust pressure, in H2O... | 26.9    | 31.3    | 39.4    | 48.9    | 72.7    | 87.0    |
| After Catalyst              |         |         |         |         |         |         |
| Concentrations, dry basis:  |         |         |         |         |         |         |
| CO, %.....                  | 0.011   | 0.015   | 0.014   | 0.014   | 2.579   | 1.107   |
| CO2, %.....                 | 11.44   | 12.30   | 12.89   | 13.75   | 13.19   | 11.67   |
| O2, %.....                  | 4.65    | 3.55    | 2.58    | 1.28    | 0.00    | 0.00    |
| HC, ppmC.....               | 17.     | 23.     | 18.     | 24.     | 32.     | 45.     |
| NOx, ppm.....               | 204.    | 291.    | 450.    | 522.    | 212.    | 172.    |
| Air-fuel ratio.....         | 18.68   | 17.51   | 16.64   | 15.58   | 13.58   | 14.07   |
| Emission rates, g/hr:       |         |         |         |         |         |         |
| CO.....                     | 14.     | 21.     | 22.     | 23.     | 5115.   | 2841.   |
| HC.....                     | 1.2     | 1.8     | 1.5     | 2.3     | 3.7     | 6.6     |
| NOx**.....                  | 43.8    | 65.5    | 112.6   | 143.0   | 69.2    | 72.6    |
| Exhaust temperature, F....  | 984.    | 1035.   | 1088.   | 1181.   | 1275.   | 1212.   |

\* Corrected - SAE J245 Spark ignition engine rating code

\*\* Corrected for humidity



AMC 304 CID

| Engine                     | 41      | 42      | 96      | 97      | 98      | 99      |
|----------------------------|---------|---------|---------|---------|---------|---------|
| Test Number                | 4/21/77 | 4/21/77 | 4/27/77 | 4/27/77 | 4/27/77 | 4/27/77 |
| Barometer, mm Hg           | 773.7   | 773.7   | 761.5   | 761.7   | 761.7   | 761.5   |
| Humidity, grains/lb        | 51.     | 54.     | 35.     | 36.     | 37.     | 35.     |
| Ambient temperature, F     | 108.    | 110.    | 89.     | 91.     | 93.     | 94.     |
| Engine speed, rpm          | 2500.   | 2500.   | 2500.   | 2500.   | 2500.   | 2500.   |
| Torque, lb-ft              | 161.0   | 186.4   | 0.3     | 17.8    | 38.2    | 56.7    |
| Power, bhp                 | 76.5    | 89.5    | 0.1     | 8.5     | 18.2    | 27.0    |
| Fuel rate, lb/hr           | 47.9    | 53.9    | 14.3    | 16.5    | 19.4    | 22.2    |
| Ignition timing, deg BTC   | 21.0    | 20.5    | 36.0    | 35.5    | 35.0    | 35.5    |
| Manifold vacuum, in Hg     | -2.0    | -1.3    | -18.4   | -16.5   | -14.4   | -12.4   |
| Throttle angle, deg        | 50.0    | 75.0    | 10.0    | 12.3    | 14.0    | 16.5    |
| Brake specific fuel cons*  | 0.627   | 0.602   | 164.500 | 1.939   | 1.070   | 0.823   |
| Oil temperature, F         | 204.    | 210.    | 159.    | 162.    | 164.    | 166.    |
| Oil pressure, PSI          | 47.     | 45.     | 47.     | 48.     | 47.     | 46.     |
| Coolant temperature, F     | 205.    | 206.    | 200.    | 201.    | 202.    | 202.    |
| Before Catalyst            |         |         |         |         |         |         |
| Exhaust temperature, F     | 1232.   | 1250.   | 992.    | 1032.   | 1077.   | 1118.   |
| Exhaust pressure, in H2O   | 105.6   | 129.3   | 20.1    | 25.9    | 32.1    | 38.5    |
| After Catalyst             |         |         |         |         |         |         |
| Concentrations, dry basis: |         |         |         |         |         |         |
| CO, %                      | 1.666   | 1.319   | 0.005   | 0.021   | 0.018   | 0.017   |
| CO2, %                     | 12.05   | 11.58   | 10.75   | 11.46   | 12.33   | 12.98   |
| O2, %                      | 0.00    | 0.00    | 5.69    | 4.64    | 3.44    | 2.54    |
| HC, ppmC                   | 48.     | 61.     | 9.      | 24.     | 24.     | 10.     |
| NOx, ppm                   | 463.    | 850.    | 114.    | 186.    | 293.    | 425.    |
| Air-fuel ratio             | 13.89   | 14.03   | 19.90   | 18.66   | 17.42   | 16.59   |
| Emission rates, g/hr:      |         |         |         |         |         |         |
| CO                         | 4581.   | 4128.   | 6.      | 27.     | 25.     | 25.     |
| HC                         | 7.6     | 11.0    | 0.6     | 1.7     | 1.9     | 0.5     |
| NOx**                      | 209.2   | 437.0   | 22.0    | 38.7    | 66.8    | 106.2   |
| Exhaust temperature, F     | 1243.   | 1255.   | 944.    | 987.    | 1039.   | 1051.   |

\* Corrected - SAE J245 Spark ignition engine rating code

\*\* Corrected for humidity

Engine..... AMC 304 CID

|                             | 100     | 101     | 102     | 103     | 104     | 44      |
|-----------------------------|---------|---------|---------|---------|---------|---------|
| Test Number.....            | 100     | 101     | 102     | 103     | 104     | 44      |
| Test Date.....              | 4/27/77 | 4/27/77 | 4/27/77 | 4/27/77 | 4/27/77 | 4/22/77 |
| Barometer, mm Hg.....       | 762.0   | 762.0   | 762.0   | 762.0   | 762.0   | 769.4   |
| Humidity, grains/lb.....    | 40.     | 42.     | 42.     | 41.     | 44.     | 68.     |
| Ambient temperature, F..... | 96.     | 100.    | 101.    | 102.    | 104.    | 89.     |
| Engine speed, rpm.....      | 2500.   | 2500.   | 2500.   | 2500.   | 2500.   | 3000.   |
| Torque, lb-ft*.....         | 76.3    | 105.2   | 133.8   | 164.0   | 195.4   | -0.0    |
| Power, bhp*.....            | 36.3    | 50.1    | 63.7    | 78.1    | 93.0    | -0.0    |
| Fuel rate, lb/hr.....       | 25.3    | 34.5    | 44.6    | 49.7    | 55.6    | 18.2    |
| Ignition timing, deg ETC..  | 33.0    | 20.5    | 21.0    | 20.0    | 20.0    | 37.0    |
| Manifold vacuum, in Hg....  | -9.7    | -4.5    | -2.8    | -2.0    | -1.4    | -17.8   |
| Throttle angle, deg.....    | 21.5    | 33.0    | 41.5    | 50.0    | 75.0    | 13.5    |
| Brake specific fuel ccns*.  | 0.698   | 0.65C   | 0.700   | 0.636   | 0.597   | *****   |
| Oil temperature, F.....     | 171.    | 177.    | 182.    | 191.    | 201.    | 182.    |
| Oil pressure, psi.....      | 47.     | 45.     | 46.     | 46.     | 45.     | 49.     |
| Coolant temperature, F..... | 202.    | 203.    | 203.    | 203.    | 205.    | 203.    |
| Before Catalyst             |         |         |         |         |         |         |
| Exhaust temperature, F....  | 1180.   | 1286.   | 1219.   | 1245.   | 1271.   | 1051.   |
| Exhaust pressure, in H2O..  | 48.4    | 72.1    | 85.8    | 104.0   | 131.3   | 25.7    |
| After Catalyst              |         |         |         |         |         |         |
| Concentrations, dry basis:  |         |         |         |         |         |         |
| CO, %.....                  | 0.023   | 2.071   | 1.421   | 1.457   | 1.300   | 0.020   |
| CO2, %.....                 | 13.65   | 13.56   | 10.93   | 11.12   | 11.25   | 13.25   |
| O2, %.....                  | 1.60    | 0.00    | 0.00    | 0.00    | 0.00    | 1.94    |
| HC, ppm.....                | 23.     | 609.    | 1294.   | 1277.   | 1292.   | 5.      |
| NOx, ppm.....               | 533.    | 316.    | 126.    | 257.    | 537.    | 197.    |
| Air-fuel ratio.....         | 15.82   | 13.74   | 13.74   | 13.77   | 13.82   | 16.11   |
| Emission rates, q/hr:       |         |         |         |         |         |         |
| CO.....                     | 37.     | 3995.   | 3642.   | 4161.   | 4165.   | 24.     |
| HC.....                     | 2.2     | 68.4    | 187.7   | 206.8   | 234.9   | 0.6     |
| NOx**.....                  | 143.0   | 100.1   | 52.8    | 120.7   | 282.5   | 38.8    |
| Exhaust temperature, F....  | 1159.   | 1285.   | 1188.   | 1216.   | 1245.   | 1080.   |

\* Corrected - SAE J245 Spark ignition engine rating code

\*\* Corrected for humidity

AMC 304 CI

| Engine                     | 45      | 46      | 47      | 48      | 49      | 50      |
|----------------------------|---------|---------|---------|---------|---------|---------|
| Test Number                | 4/22/77 | 4/22/77 | 4/22/77 | 4/22/77 | 4/22/77 | 4/22/77 |
| Barometer, mm Hg           | 769.4   | 769.4   | 769.6   | 769.6   | 769.6   | 768.6   |
| Humidity, grains/lb        | 69.     | 70.     | 69.     | 71.     | 72.     | 72.     |
| Ambient temperature, F     | 92.     | 94.     | 99.     | 101.    | 105.    | 100.    |
| Engine speed, rpm          | 3000.   | 3000.   | 3000.   | 3000.   | 3000.   | 3000.   |
| Torque, lb-ft              | 17.5    | 31.8    | 50.6    | 68.7    | 91.0    | 115.5   |
| Power, bhp                 | 10.0    | 18.1    | 28.8    | 39.1    | 51.9    | 65.1    |
| Fuel rate, lb/hr           | 21.9    | 23.9    | 27.3    | 31.5    | 40.8    | 49.7    |
| Ignition timing, deg BTC   | 37.0    | 37.0    | 37.0    | 34.5    | 22.0    | 22.0    |
| Manifold vacuum, in Hg     | -15.8   | -14.2   | -11.9   | -9.6    | -4.5    | -3.0    |
| Throttle angle, deg        | 15.0    | 17.0    | 20.0    | 25.0    | 36.5    | 45.0    |
| Brake specific fuel cons*  | 2.198   | 1.320   | 0.948   | 0.806   | 0.786   | 0.763   |
| Oil temperature, F         | 190.    | 196.    | 201.    | 206.    | 215.    | 215.    |
| Oil pressure, psi          | 49.     | 49.     | 48.     | 47.     | 46.     | 48.     |
| Coolant temperature, F     | 203.    | 204.    | 204.    | 205.    | 206.    | 205.    |
| Before Catalyst            |         |         |         |         |         |         |
| Exhaust temperature, F     | 1124.   | 1146.   | 1172.   | 1207.   | 1317.   | 1306.   |
| Exhaust pressure, in H2O   | 33.6    | 40.6    | 51.3    | 64.8    | 97.5    | 116.5   |
| After Catalyst             |         |         |         |         |         |         |
| Concentrations, dry basis: |         |         |         |         |         |         |
| CO, %                      | 0.074   | 0.014   | 0.016   | 0.071   | 1.529   | 1.293   |
| CO2, %                     | 13.66   | 13.96   | 14.18   | 14.68   | 13.78   | 12.00   |
| O2, %                      | 1.36    | 1.03    | 0.77    | 0.05    | 0.00    | 0.00    |
| HC, ppmC                   | 20.     | 21.     | 22.     | 32.     | 29.     | 40.     |
| NOx, ppm                   | 285.    | 362.    | 525.    | 412.    | 362.    | 200.    |
| Air-fuel ratio             | 15.62   | 15.35   | 15.20   | 14.67   | 13.93   | 13.98   |
| Emission rates, g/hr:      |         |         |         |         |         |         |
| CO                         | 103.    | 21.     | 28.     | 133.    | 3531.   | 3716.   |
| HC                         | 1.6     | 1.8     | 2.2     | 3.5     | 3.9     | 6.6     |
| NOx**                      | 65.2    | 85.2    | 145.8   | 126.8   | 137.2   | 94.6    |
| Exhaust temperature, F     | 1126.   | 1159.   | 1195.   | 1271.   | 1326.   | 1283.   |

\* Corrected - SAE J245 Spark ignition engine rating code

\*\* Corrected for humidity



AMC 304 CID

| Engine                     | 51      | 52      | 106     | 107     | 108     | 109     |
|----------------------------|---------|---------|---------|---------|---------|---------|
| Test Number                | 4/22/77 | 4/22/77 | 4/28/77 | 4/28/77 | 4/28/77 | 4/28/77 |
| Barometer, mm Hg           | 768.4   | 768.1   | 756.4   | 756.2   | 756.2   | 755.7   |
| Humidity, grains/lb        | 73.     | 73.     | 44.     | 44.     | 46.     | 45.     |
| Ambient temperature, F     | 105.    | 109.    | 88.     | 91.     | 94.     | 96.     |
| Engine speed, rpm          | 3000.   | 3000.   | 3000.   | 3000.   | 3000.   | 3000.   |
| Torque, lb-ft*             | 141.5   | 161.7   | 0.6     | 16.8    | 32.8    | 50.4    |
| Power, bhp*                | 80.7    | 91.5    | 0.3     | 9.6     | 18.7    | 28.8    |
| Fuel rate, lb/hr           | 53.4    | 58.1    | 17.9    | 20.6    | 23.5    | 26.4    |
| Ignition timing, deg ETC   | 22.0    | 22.0    | 37.0    | 36.5    | 37.0    | 37.0    |
| Manifold vacuum, in Hg     | -2.0    | -1.6    | -17.5   | -15.8   | -14.1   | -12.0   |
| Throttle angle, deg        | 55.0    | 75.0    | 14.0    | 15.5    | 18.0    | 20.0    |
| Brake specific fuel ccms*  | 0.662   | 0.632   | 70.950  | 2.163   | 1.255   | 0.918   |
| Oil temperature, F         | 226.    | 233.    | 177.    | 180.    | 186.    | 190.    |
| Oil pressure, psi          | 47.     | 46.     | 50.     | 48.     | 48.     | 47.     |
| Coolant temperature, F     | 206.    | 206.    | 201.    | 203.    | 203.    | 204.    |
| Refcld Catalyst            |         |         |         |         |         |         |
| Exhaust temperature, F     | 1361.   | 1380.   | 1168.   | 1193.   | 1217.   | 1233.   |
| Exhaust pressure, in H2O   | 143.2   | 166.1   | 26.0    | 32.7    | 40.4    | 50.1    |
| After Catalyst             |         |         |         |         |         |         |
| Concentrations, dry basis: |         |         |         |         |         |         |
| CO, %                      | 3.437   | 3.301   | 0.015   | 0.020   | 0.025   | 0.024   |
| CO2, %                     | 12.79   | 12.54   | 13.60   | 13.93   | 14.21   | 14.35   |
| O2, %                      | 0.10    | 0.00    | 1.72    | 1.16    | 0.87    | 0.56    |
| HC, ppmC                   | 52.     | 56.     | 9.      | 15.     | 12.     | 17.     |
| NOx, ppm                   | 672.    | 1160.   | 171.    | 241.    | 329.    | 456.    |
| Air-fuel ratio             | 13.34   | 13.23   | 15.91   | 15.49   | 15.26   | 15.05   |
| Emission rates, g/hr:      |         |         |         |         |         |         |
| CO                         | 9984.   | 10411.  | 17.     | 26.     | 37.     | 38.     |
| HC                         | 8.8     | 10.3    | 0.6     | 1.1     | 1.0     | 1.6     |
| NOx**                      | 320.7   | 601.1   | 32.6    | 51.6    | 78.7    | 120.5   |
| Exhaust temperature, F     | 1337.   | 1356.   | 1104.   | 1142.   | 1181.   | 1217.   |

\* Corrected - SAE J245 Spark ignition engine rating code

\*\* Corrected for humidity



AMC 304 CIL

| Engine                                | 110     | 111     | 112     | 113     | 114     | 54      |
|---------------------------------------|---------|---------|---------|---------|---------|---------|
| Test Number                           | 4/28/77 | 4/28/77 | 4/28/77 | 4/28/77 | 4/28/77 | 4/23/77 |
| Barometer, mm Hg                      | 755.7   | 756.2   | 756.2   | 755.9   | 755.9   | 770.1   |
| Humidity, grains/lb                   | 46.     | 48.     | 45.     | 44.     | 43.     | 58.     |
| Ambient temperature, F                | 98.     | 104.    | 104.    | 107.    | 111.    | 94.     |
| Engine speed, rpm                     | 3000.   | 3000.   | 3000.   | 3000.   | 3000.   | 3600.   |
| Torque, lb-ft                         | 67.6    | 93.5    | 118.2   | 144.9   | 167.7   | 0.3     |
| Power, bhp                            | 38.6    | 53.6    | 67.5    | 82.5    | 95.7    | 0.2     |
| Fuel rate, lb/hr                      | 29.9    | 39.8    | 49.4    | 52.6    | 56.9    | 23.8    |
| Ignition timing, deg BTC              | 34.0    | 22.5    | 22.0    | 21.5    | 22.0    | 38.5    |
| Manifold vacuum, in Hg                | -9.8    | -4.7    | -3.0    | -2.0    | -1.5    | -16.5   |
| Throttle angle, deg                   | 20.0    | 37.0    | 45.0    | 55.0    | 75.0    | 16.5    |
| Brake specific fuel cons*             | 0.774   | 0.743   | 0.733   | 0.638   | 0.594   | 101.600 |
| Oil temperature, F                    | 196.    | 205.    | 209.    | 218.    | 225.    | 220.    |
| Oil pressure, psi                     | 47.     | 46.     | 46.     | 45.     | 45.     | 50.     |
| Coolant temperature, F                | 204.    | 205.    | 205.    | 205.    | 206.    | 207.    |
| Before Catalyst                       |         |         |         |         |         |         |
| Exhaust temperature, F                | 1261.   | 1364.   | 1310.   | 1367.   | 1408.   | 1251.   |
| Exhaust pressure, in H <sub>2</sub> O | 62.4    | 95.5    | 114.2   | 140.8   | 167.1   | 41.6    |
| After catalyst                        |         |         |         |         |         |         |
| Concentrations, dry basis:            |         |         |         |         |         |         |
| CO, %                                 | 0.050   | 1.733   | 1.435   | 3.740   | 2.865   | 0.030   |
| CO <sub>2</sub> , %                   | 14.77   | 13.94   | 11.78   | 12.84   | 13.26   | 13.84   |
| O <sub>2</sub> , %                    | 0.14    | 0.60    | 0.00    | 0.00    | 0.02    | 1.35    |
| HC, ppmC                              | 23.     | 635.    | 1090.   | 560.    | 824.    | 114.    |
| NOx, ppm                              | 499.    | 357.    | 187.    | 602.    | 1321.   | 262.    |
| Air-fuel ratio                        | 14.74   | 13.65   | 13.84   | 13.09   | 13.46   | 15.61   |
| Emission rates, g/hr:                 |         |         |         |         |         |         |
| CO                                    | 89.     | 3890.   | 4072.   | 10490.  | 8927.   | 45.     |
| HC                                    | 2.4     | 83.1    | 176.5   | 157.1   | 149.6   | 9.5     |
| NOx**                                 | 146.2   | 131.6   | 87.2    | 277.4   | 676.2   | 65.1    |
| Exhaust temperature, F                | 1270.   | 1325.   | 1275.   | 1332.   | 1373.   | 1193.   |

\* Corrected - SAE J245 Spark ignition engine rating code

\*\* Corrected for humidity

Engine..... AMC 304 CID

|                                | 55      | 56      | 57      | 58      | 59      | 60      |
|--------------------------------|---------|---------|---------|---------|---------|---------|
| Test Number.....               | 4/23/77 | 4/23/77 | 4/23/77 | 4/23/77 | 4/23/77 | 4/23/77 |
| Barometer, mm Hg.....          | 770.1   | 770.6   | 770.6   | 771.1   | 771.4   | 771.7   |
| Humidity, grains/lb.....       | 58.     | 56.     | 56.     | 57.     | 58.     | 58.     |
| Ambient temperature, F.....    | 97.     | 99.     | 101.    | 103.    | 107.    | 106.    |
| Engine speed, rpm.....         | 3600.   | 3600.   | 3600.   | 3600.   | 3600.   | 3600.   |
| Torque, lb-ft*.....            | 11.4    | 24.0    | 36.8    | 50.1    | 70.4    | 85.5    |
| Power, bhp*.....               | 7.8     | 16.5    | 25.2    | 34.2    | 48.1    | 61.2    |
| Fuel rate, lb/hr.....          | 23.8    | 29.6    | 32.4    | 36.1    | 47.5    | 54.5    |
| Ignition timing, deg ETC.....  | 38.5    | 38.0    | 38.0    | 35.0    | 23.0    | 23.0    |
| Manifold vacuum, in Hg.....    | -14.8   | -13.3   | -11.6   | -9.7    | -4.6    | -3.4    |
| Throttle angle, deg.....       | 16.5    | 22.0    | 25.0    | 28.0    | 41.0    | 46.5    |
| Brake specific fuel cnsm*..... | 3.036   | 1.800   | 1.287   | 1.056   | 0.987   | 0.890   |
| Oil temperature, F.....        | 223.    | 227.    | 231.    | 234.    | 244.    | 248.    |
| Oil pressure, psi.....         | 50.     | 45.     | 49.     | 49.     | 48.     | 47.     |
| Coolant temperature, F.....    | 206.    | 206.    | 208.    | 207.    | 209.    | 210.    |
| Before Catalyst                |         |         |         |         |         |         |
| Exhaust temperature, F.....    | 1282.   | 1300.   | 1314.   | 1354.   | 1480.   | 1426.   |
| Exhaust pressure, in H2O.....  | 51.1    | 61.C    | 71.9    | 86.6    | 134.6   | 149.6   |
| After Catalyst                 |         |         |         |         |         |         |
| Concentrations, dry basis:     |         |         |         |         |         |         |
| CO, %.....                     | 0.018   | 0.018   | 0.018   | 0.018   | 0.984   | 3.155   |
| CO2, %.....                    | 13.82   | 14.03   | 13.97   | 14.30   | 14.05   | 12.55   |
| O2, %.....                     | 0.99    | 0.88    | 0.90    | 0.54    | 0.00    | 0.00    |
| HC, ppm.....                   | 95.     | 102.    | 109.    | 130.    | 323.    | 464.    |
| NOx, ppm.....                  | 331.    | 410.    | 515.    | 577.    | 387.    | 288.    |
| Air-fuel ratio.....            | 15.36   | 15.27   | 15.29   | 15.02   | 14.20   | 13.33   |
| Emission rates, g/hr:          |         |         |         |         |         |         |
| CO.....                        | 27.     | 33.     | 36.     | 40.     | 2698.   | 9336.   |
| HC.....                        | 8.1     | 10.9    | 12.7    | 16.6    | 51.4    | 83.4    |
| NOx**.....                     | 80.9    | 124.2   | 170.8   | 209.0   | 174.1   | 135.5   |
| Exhaust temperature, F.....    | 1228.   | 1249.   | 1266.   | 1316.   | 1438.   | 1390.   |

\* Corrected - SAE J245 Spark ignition engine rating code

\*\* Corrected for humidity

Engine..... AMC 304 CID

|                            | 61      | 62      | 115     | 116     | 117     | 118     |
|----------------------------|---------|---------|---------|---------|---------|---------|
| Test Number.....           | 4/23/77 | 4/23/77 | 4/28/77 | 4/28/77 | 4/28/77 | 4/28/77 |
| Barometer, mm Hg.....      | 771.9   | 772.2   | 754.9   | 754.9   | 755.1   | 755.1   |
| Humidity, grains/lb.....   | 58.     | 59.     | 37.     | 36.     | 36.     | 32.     |
| Ambient temperature, F.... | 111.    | 112.    | 105.    | 105.    | 107.    | 107.    |
| Engine speed, rpm.....     | 3600.   | 3600.   | 3600.   | 3600.   | 3600.   | 3600.   |
| Torque, lb-ft*.....        | 108.1   | 123.2   | 1.0     | 13.2    | 25.0    | 38.8    |
| Power, bhp*.....           | 74.0    | 84.5    | 0.7     | 9.0     | 17.2    | 26.6    |
| Fuel rate, lb/hr.....      | 58.1    | 61.2    | 23.1    | 25.9    | 28.6    | 31.2    |
| Ignition timing, deg FTC.. | 22.0    | 23.0    | 37.5    | 38.0    | 37.0    | 38.0    |
| Manifold vacuum, in Hg.... | -2.2    | -1.5    | -16.3   | -14.9   | -13.3   | -11.5   |
| Throttle angle, deg.....   | 59.5    | 75.0    | 17.0    | 20.0    | 22.0    | 24.5    |
| Brake specific fuel cons*. | 0.786   | 0.725   | 39.010  | 2.867   | 1.670   | 1.174   |
| Oil temperature, F.....    | 252.    | 257.    | 222.    | 224.    | 228.    | 230.    |
| Oil pressure, PSI.....     | 46.     | 46.     | 50.     | 50.     | 49.     | 45.     |
| Coolant temperature, F.... | 209.    | 209.    | 207.    | 205.    | 207.    | 207.    |
| Reform Catalyst            |         |         |         |         |         |         |
| Exhaust temperature, F.... | 1477.   | 1506.   | 1278.   | 1300.   | 1320.   | 1323.   |
| Exhaust pressure, in H2O.. | 177.4   | 198.6   | 40.1    | 48.8    | 58.3    | 67.6    |
| After Catalyst             |         |         |         |         |         |         |
| Concentrations, dry basis: |         |         |         |         |         |         |
| CO, %.....                 | 2.260   | 1.722   | 0.016   | 0.022   | 0.020   | 0.023   |
| CO2, %.....                | 13.38   | 13.79   | 14.45   | 14.48   | 14.59   | 14.72   |
| O2, %.....                 | 0.00    | 0.00    | 0.84    | 0.61    | 0.40    | 0.33    |
| HC, ppm.....               | 439.    | 456.    | 13.     | 7.      | 3.      | 11.     |
| NOx, ppm.....              | 598.    | 1081.   | 207.    | 270.    | 339.    | 459.    |
| Air-fuel ratio.....        | 13.68   | 13.92   | 15.24   | 15.08   | 14.94   | 14.88   |
| Emission rates, g/hr:      |         |         |         |         |         |         |
| CO.....                    | 7316.   | 5960.   | 22.     | 36.     | 35.     | 43.     |
| HC.....                    | 82.7    | 91.9    | 1.1     | 0.6     | 0.3     | 1.3     |
| NOx**.....                 | 317.8   | 614.7   | 48.5    | 70.3    | 96.7    | 142.0   |
| Exhaust temperature, F.... | 1444.   | 1474.   | 1219.   | 1252.   | 1280.   | 1288.   |

\* Corrected - SAE J45 Spark ignition engine rating code

\*\* Corrected for humidity



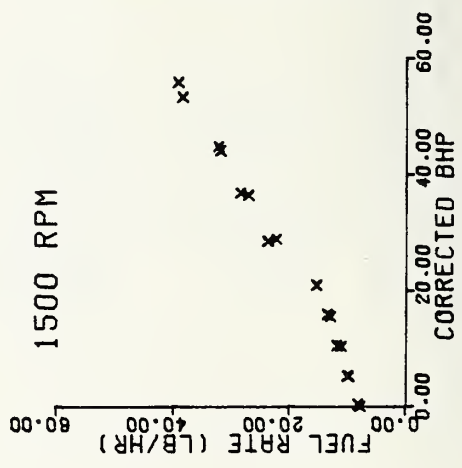
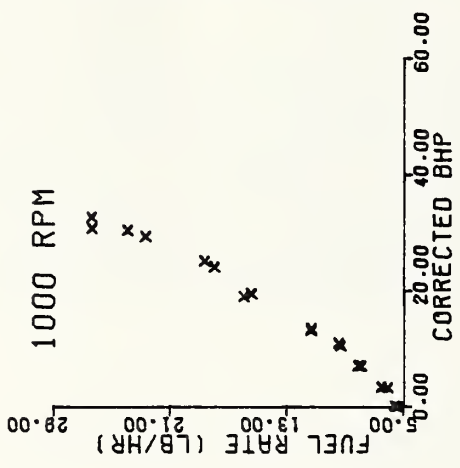
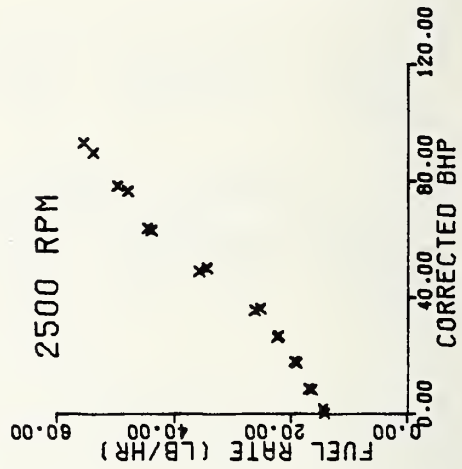
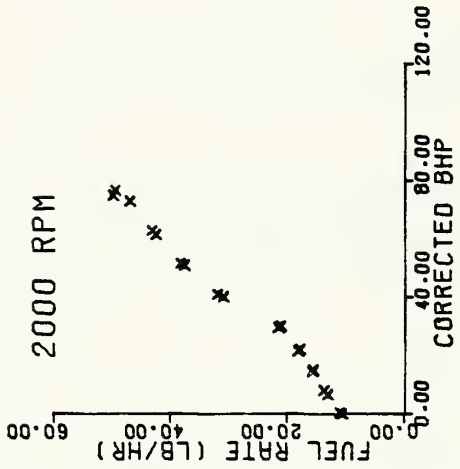
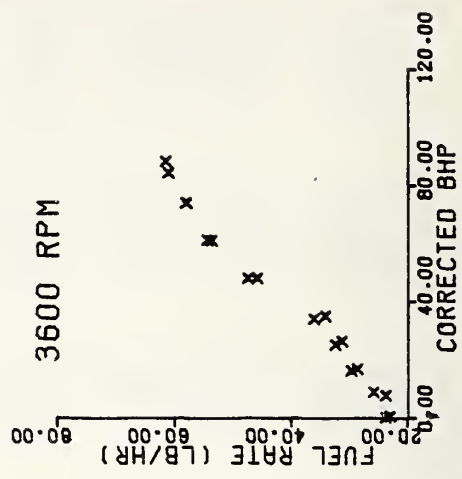
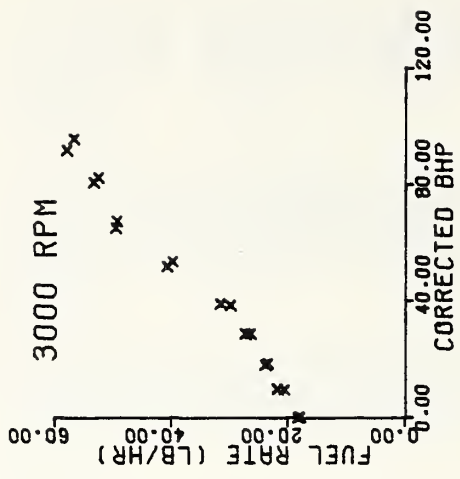
AMC 304 CID

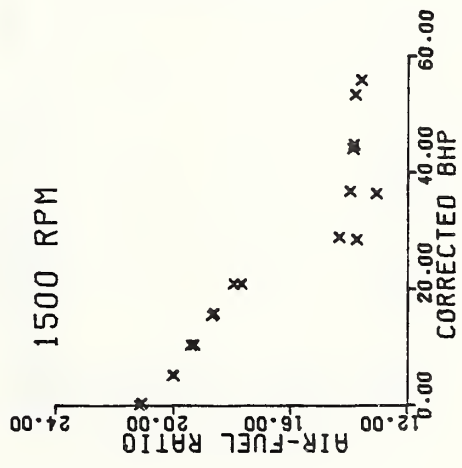
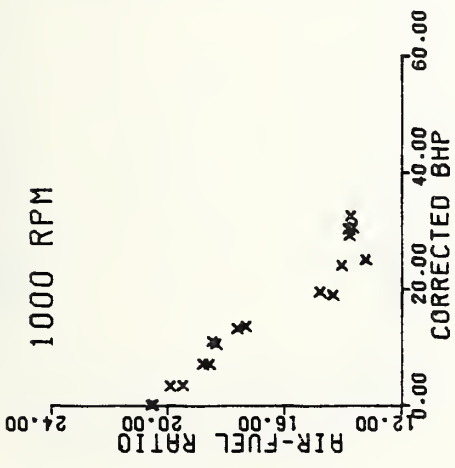
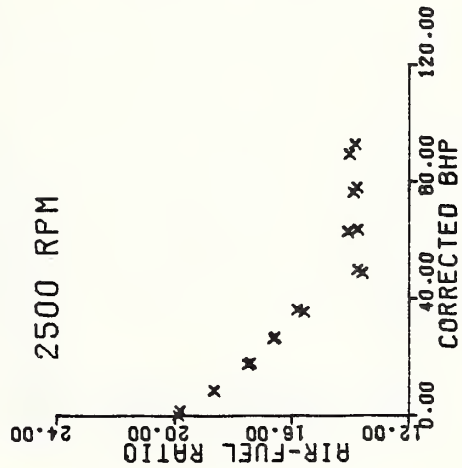
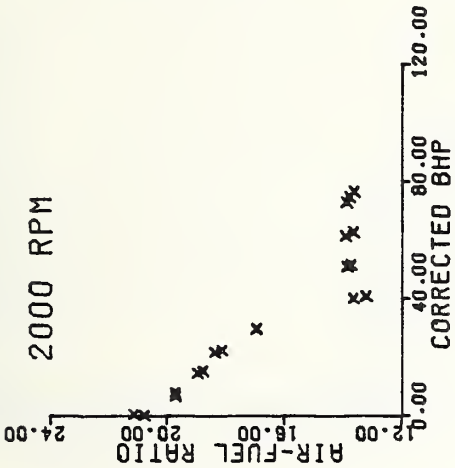
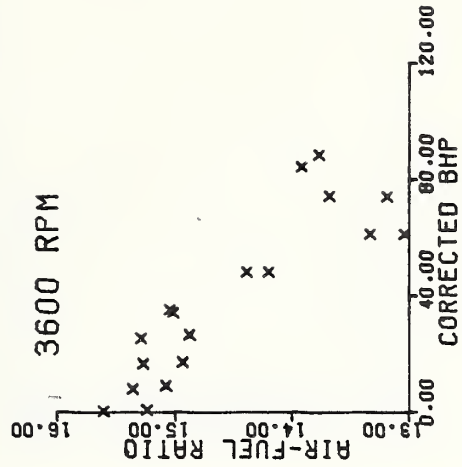
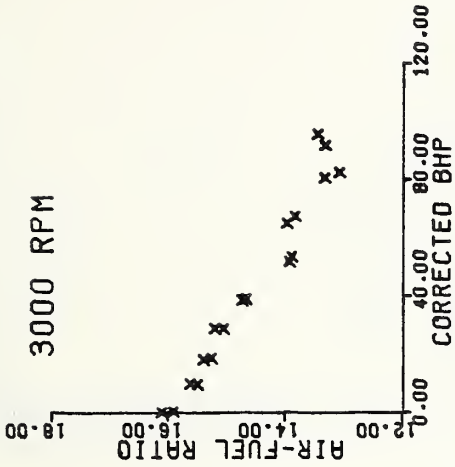
|                             |         |         |         |         |         |  |  |  |  |
|-----------------------------|---------|---------|---------|---------|---------|--|--|--|--|
| Engine.....                 |         |         |         |         |         |  |  |  |  |
| Test Number.....            | 119     | 121     | 122     | 123     | 124     |  |  |  |  |
| Test Date.....              | 4/28/77 | 4/29/77 | 4/29/77 | 4/25/77 | 4/29/77 |  |  |  |  |
| Barometer, mm Hg.....       | 755.1   | 767.1   | 767.1   | 767.1   | 767.1   |  |  |  |  |
| Humidity, grains/lb.....    | 29.     | 24.     | 24.     | 21.     | 23.     |  |  |  |  |
| Ambient temperature, F....  | 108.    | 99.     | 103.    | 105.    | 107.    |  |  |  |  |
| Engine speed, rpm.....      | 3600.   | 3600.   | 3600.   | 3600.   | 3600.   |  |  |  |  |
| Torque, lb-ft*.....         | 51.2    | 70.2    | 89.1    | 107.9   | 128.9   |  |  |  |  |
| Power, bhp*.....            | 35.1    | 48.1    | 61.1    | 74.0    | 88.4    |  |  |  |  |
| Fuel rate, lb/hr.....       | 34.1    | 45.9    | 53.8    | 58.2    | 61.7    |  |  |  |  |
| Ignition timing, deg BTC..  | 36.0    | 23.0    | 22.0    | 22.0    | 22.0    |  |  |  |  |
| Manifold vacuum, in Hg....  | -10.1   | -4.6    | -3.8    | -2.5    | -1.9    |  |  |  |  |
| Throttle angle, deg.....    | 27.0    | 40.0    | 45.0    | 55.5    | 75.5    |  |  |  |  |
| Brake specific fuel cons*.  | 0.972   | 0.954   | 0.880   | 0.787   | 0.698   |  |  |  |  |
| Oil temperature, F.....     | 233.    | 239.    | 243.    | 248.    | 253.    |  |  |  |  |
| Oil pressure, psi.....      | 49.     | 48.     | 47.     | 46.     | 45.     |  |  |  |  |
| Coolant temperature, F..... | 207.    | 208.    | 207.    | 208.    | 209.    |  |  |  |  |
| Before Catalyst             |         |         |         |         |         |  |  |  |  |
| Exhaust temperature, F....  | 1342.   | 1503.   | 1416.   | 1447.   | 1495.   |  |  |  |  |
| Exhaust pressure, in H2O..  | 79.9    | 132.1   | 143.4   | 168.3   | 197.6   |  |  |  |  |
| After Catalyst              |         |         |         |         |         |  |  |  |  |
| Concentrations, dry basis:  |         |         |         |         |         |  |  |  |  |
| CO, %.....                  | 0.019   | 0.542   | 3.893   | 3.422   | 2.131   |  |  |  |  |
| CO2, %.....                 | 14.58   | 14.28   | 12.44   | 12.69   | 13.58   |  |  |  |  |
| O2, %.....                  | 0.57    | 0.00    | 0.00    | 0.00    | 0.03    |  |  |  |  |
| HC, ppmC.....               | 14.     | 115.    | 816.    | 745.    | 517.    |  |  |  |  |
| NOx, ppm.....               | 570.    | 433.    | 241.    | 416.    | 1035.   |  |  |  |  |
| Air-fuel ratio.....         | 15.05   | 14.39   | 13.04   | 13.19   | 13.77   |  |  |  |  |
| Emission rates, g/hr:       |         |         |         |         |         |  |  |  |  |
| CO.....                     | 40.     | 1454.   | 11153.  | 10731.  | 7357.   |  |  |  |  |
| HC.....                     | 1.7     | 18.5    | 136.0   | 135.9   | 103.9   |  |  |  |  |
| NOx**.....                  | 194.8   | 190.5   | 113.4   | 214.3   | 587.0   |  |  |  |  |
| Exhaust temperature, F....  | 1298.   | 1459.   | 1376.   | 1408.   | 1457.   |  |  |  |  |

\* Corrected - SAE J245 Spark ignition engine rating code

\*\* Corrected for humidity

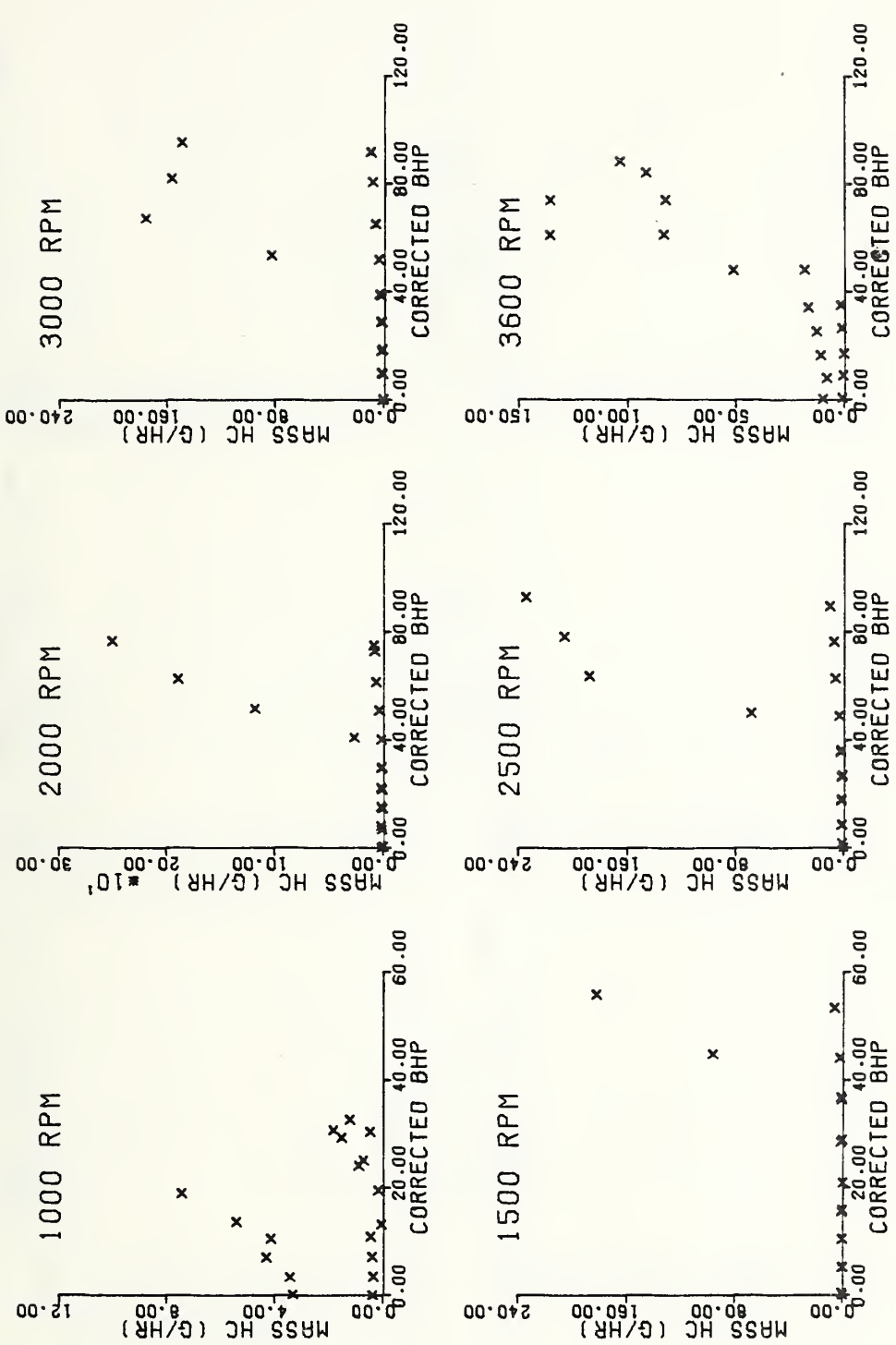
APPENDIX B      GRAPHICAL SUMMARY OF ENGINE MAP DATA

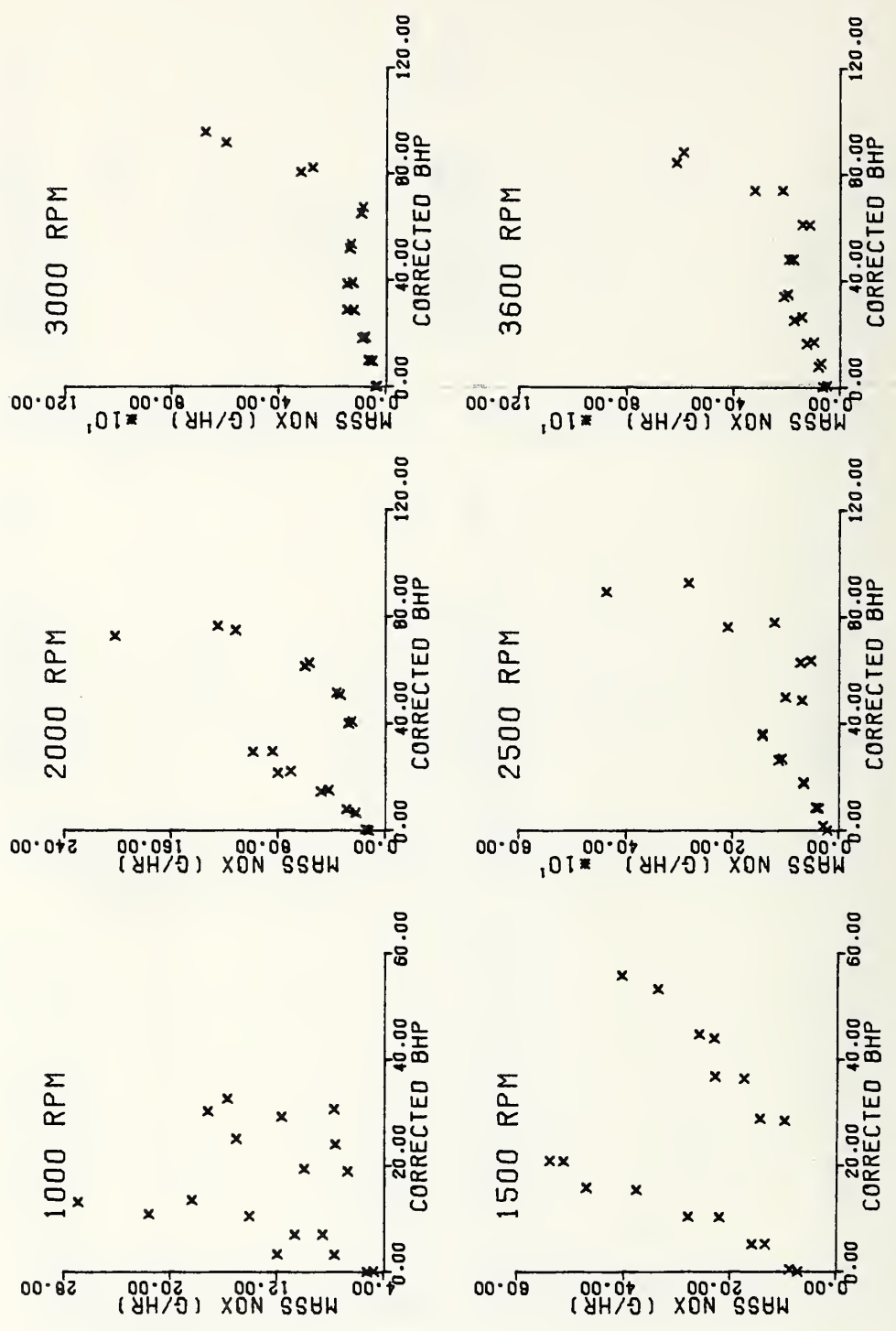


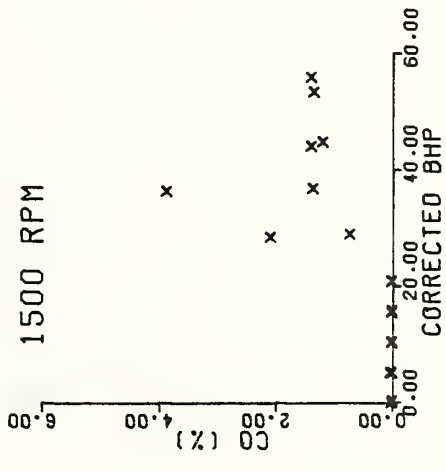
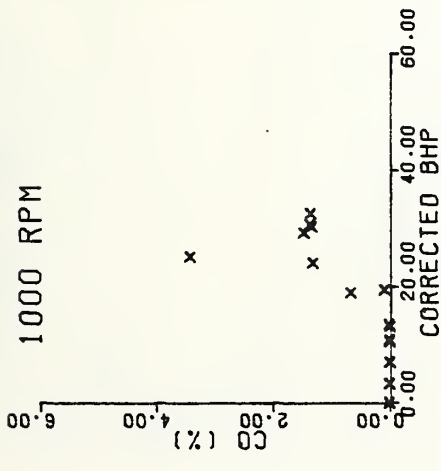
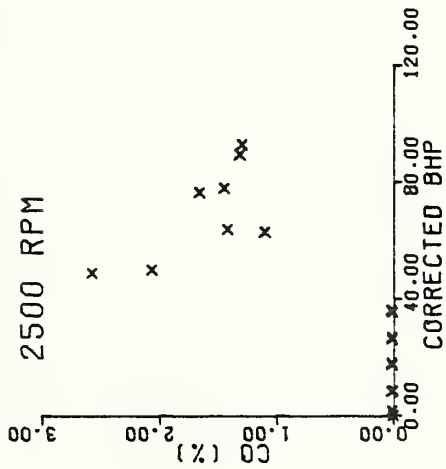
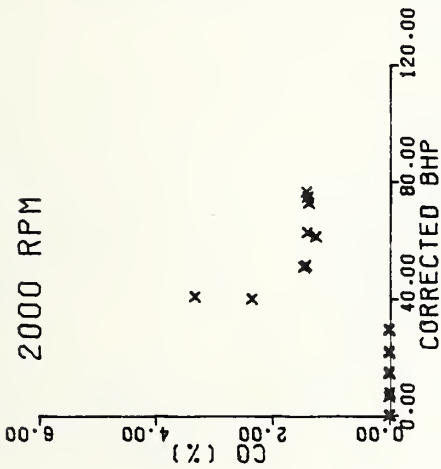
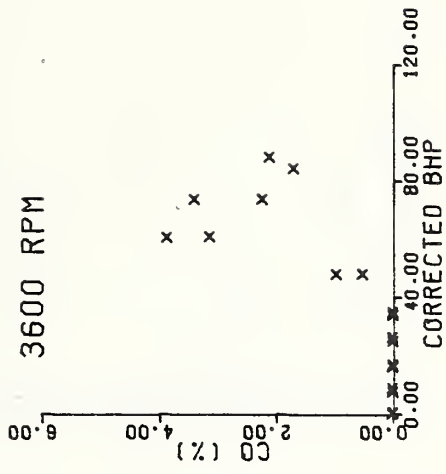
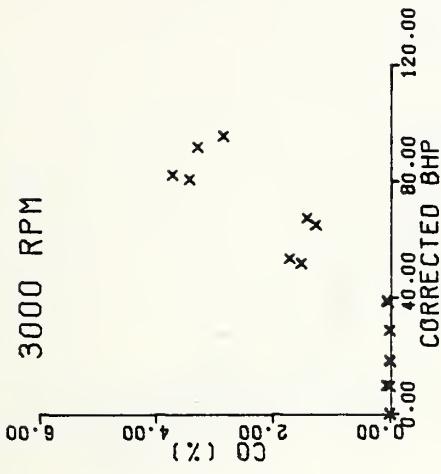


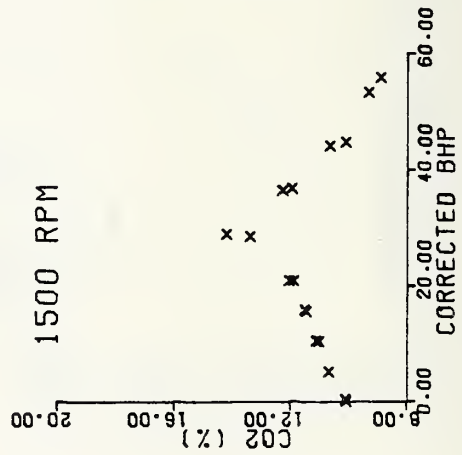
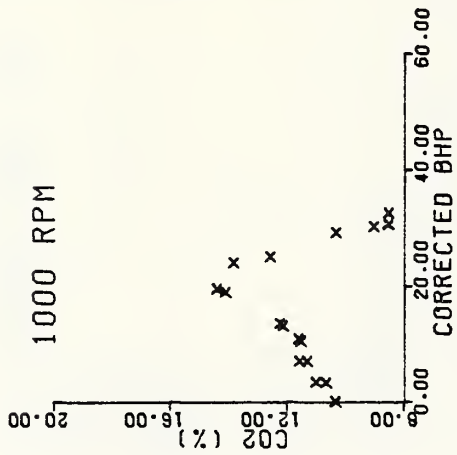
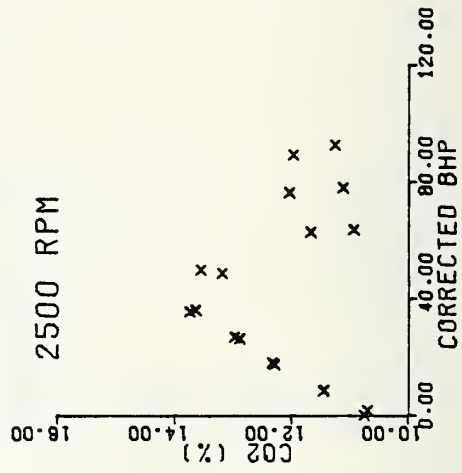
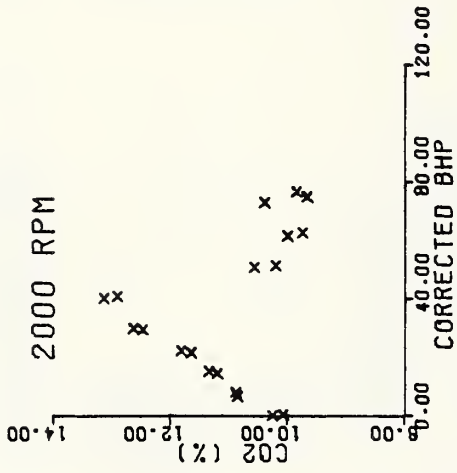
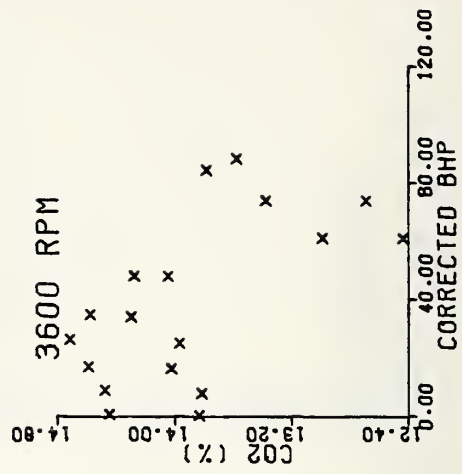
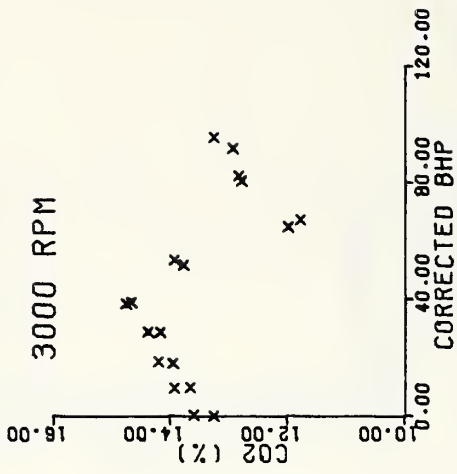


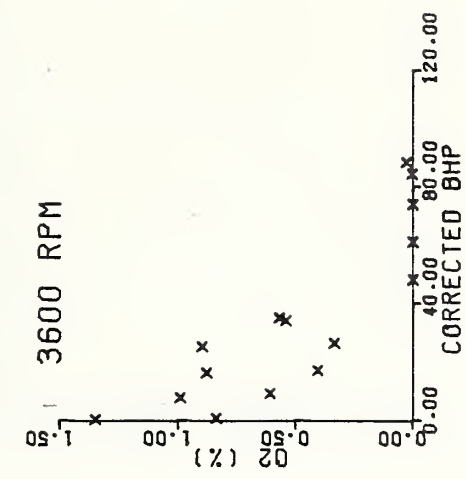
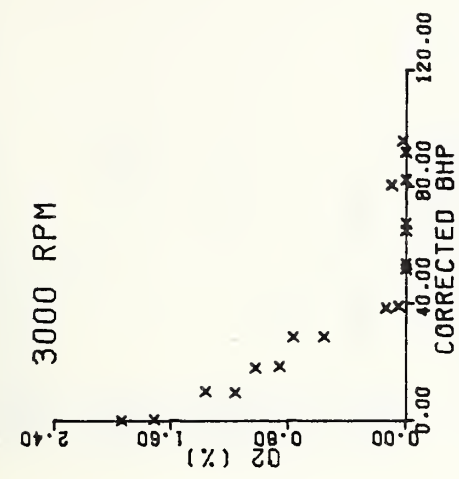
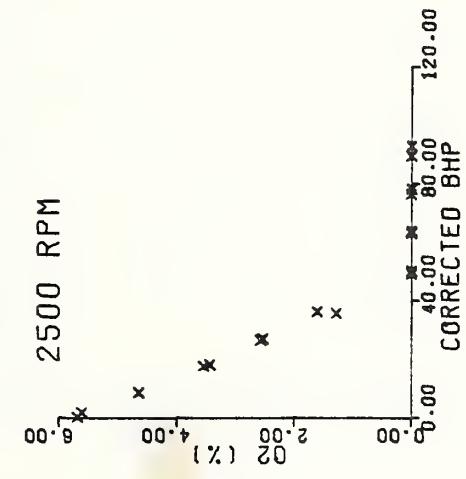
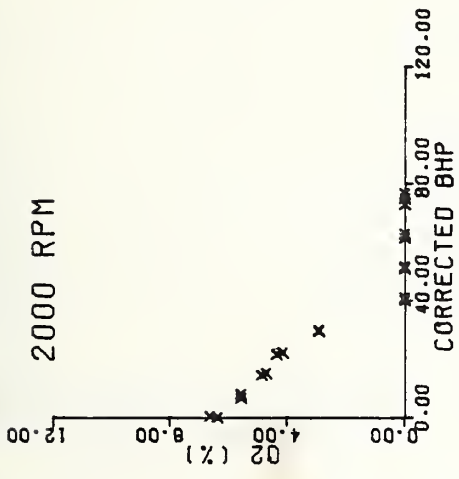
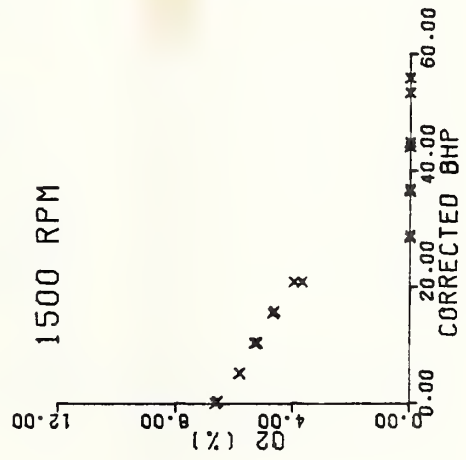
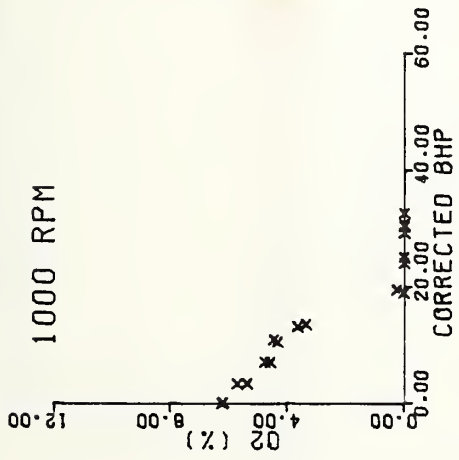


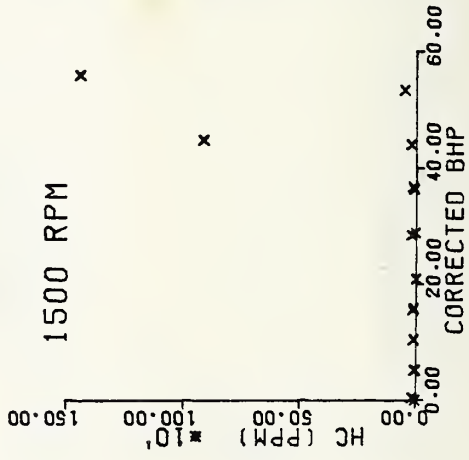
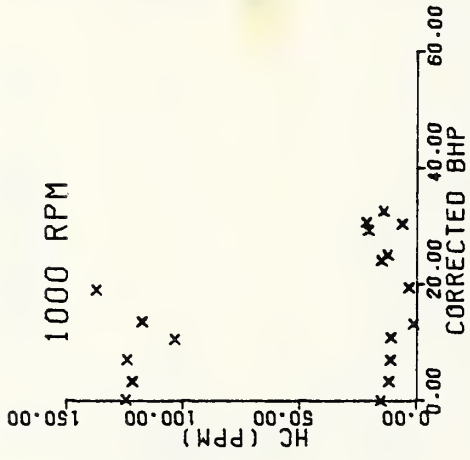
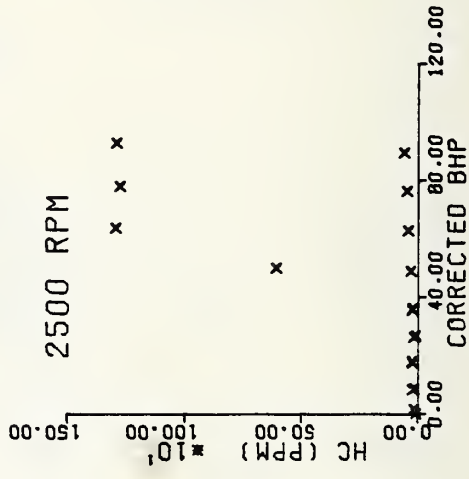
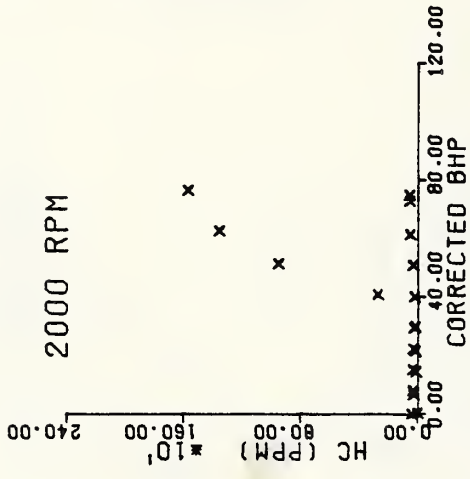
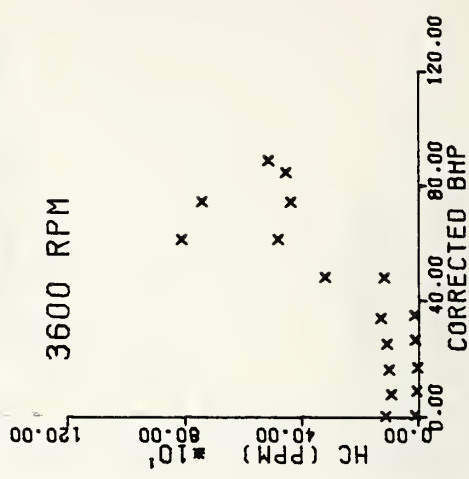
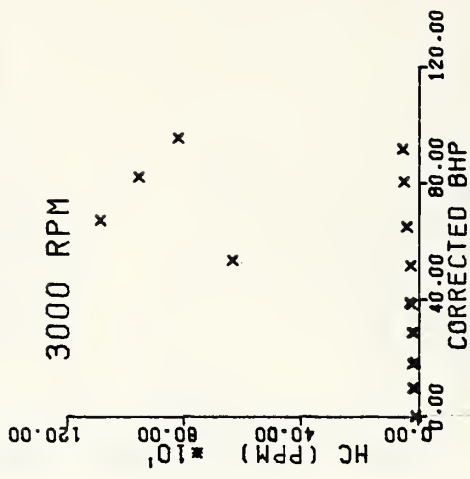


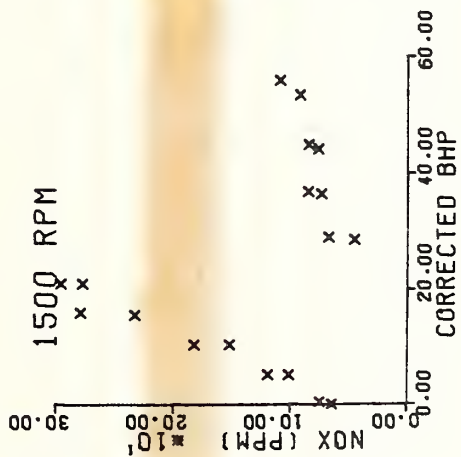
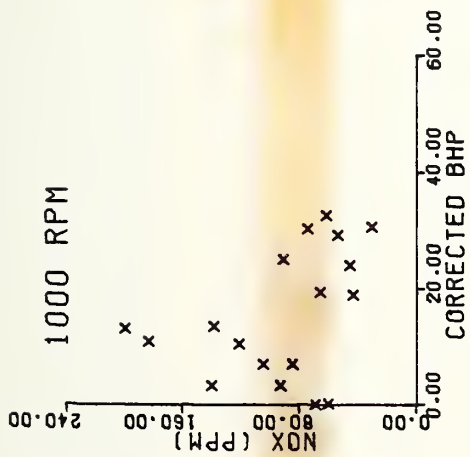
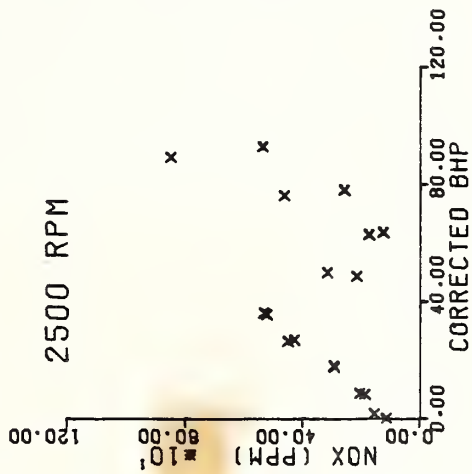
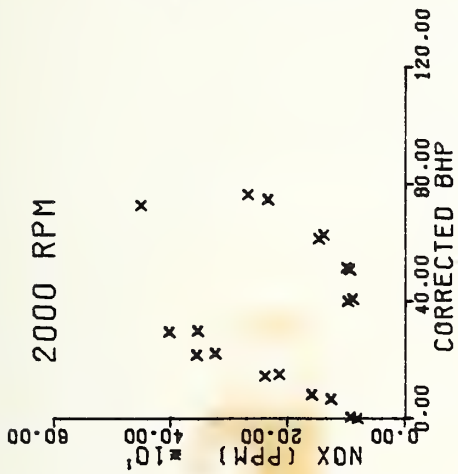
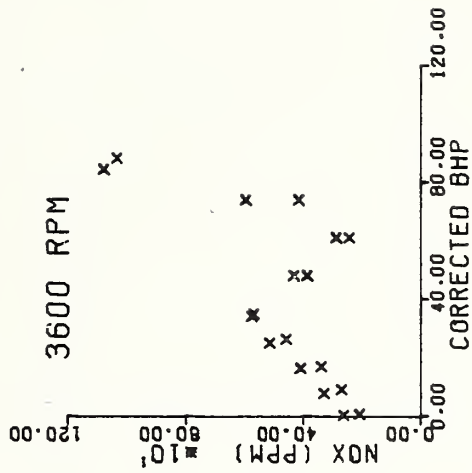
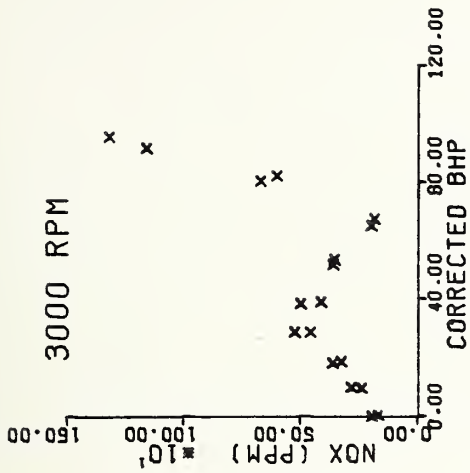












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