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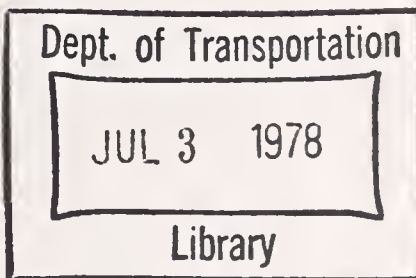
NO. DOT-TSC-NHTSA-78-5

HS-803 278

PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE
ENGINES IN THE UNITED STATES
First Series --Report No. 12
1975 Perkins Diesel 247 CID (4.0 Liters), F. I.

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APRIL 1978

INTERIM REPORT

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INFORMATION SERVICE, SPRINGFIELD,
VIRGINIA 22161

Prepared for
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
Office of Research and Development
Washington DC 20590

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16. Abstract Experimental data were obtained in dynamometer tests of a 1975 Perkins 247-CID diesel 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.				
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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 performed to obtain information on performance characteristics of an engine suitable for use 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

When You Know	Symbol	Multiply by	To Find	Symbol
LENGTH				
inches	in	2.5	centimeters	cm
feet	ft	30	centimeters	cm
yards	yd	0.9	meters	m
miles	mi	1.6	kilometers	km

When You Know	Symbol	Multiply by	To Find	Symbol
AREA				
square inches	in ²	6.5	square centimeters	cm ²
square feet	ft ²	0.09	square meters	m ²
square yards	yd ²	0.8	square meters	m ²
square miles	mi ²	2.6	square kilometers	km ²
acres		0.4	hectares	ha

When You Know	Symbol	Multiply by	To Find	Symbol
MASS (weight)				
ounces	oz	28	grams	g
pounds	lb	0.45	kilograms	kg
short tons (2000 lb)		0.9	tonnes	t

When You Know	Symbol	Multiply by	To Find	Symbol
VOLUME				
teaspoons	tsp	5	milliliters	ml
tablespoons	Tbsp	15	milliliters	ml
fluid ounces	fl oz	30	milliliters	ml
cups	c	0.24	liters	l
pints	pt	0.47	liters	l
quarts	qt	0.95	liters	l
gallons	gal	3.8	liters	l
cubic feet	ft ³	0.03	cubic meters	m ³
cubic yards	yd ³	0.76	cubic meters	m ³

When You Know	Symbol	Temperature (exact)	To Find	Symbol
TEMPERATURE (exact)				
Fahrenheit temperature	°F	$5/9$ (after subtracting 32)	Celsius temperature	°C

Approximate Conversions from Metric Measures

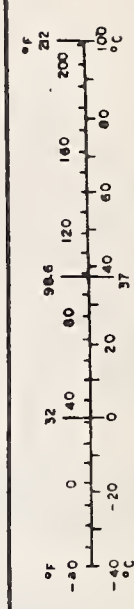
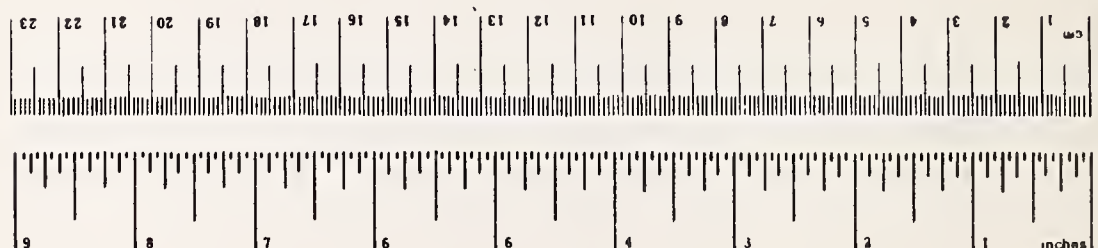
When You Know	Symbol	Multiply by	To Find	Symbol
LENGTH				
millimeters	mm	0.04	inches	in
centimeters	cm	0.4	inches	in
meters	m	3.3	feet	ft
kilometers	km	1.1	yards	yd
		0.6	miles	mi

When You Know	Symbol	Multiply by	To Find	Symbol
AREA				
square centimeters	cm ²	0.16	square inches	in ²
square meters	m ²	1.2	square yards	yd ²
square kilometers	km ²	0.4	square miles	mi ²
hectares (10,000 m ²)	ha	2.5	acres	

When You Know	Symbol	Multiply by	To Find	Symbol
MASS (weight)				
grams	g	0.035	ounces	oz
kilograms	kg	2.2	pounds	lb
tonnes (1000 kg)	t	1.1	short tons	

When You Know	Symbol	Multiply by	To Find	Symbol
VOLUME				
milliliters	ml	0.03	fluid ounces	fl oz
liters	l	2.1	pints	pt
liters	l	1.06	quarts	qt
liters	l	0.26	gallons	gal
cubic meters	m ³	35	cubic feet	ft ³
cubic meters	m ³	1.3	cubic yards	yd ³

When You Know	Symbol	Temperature (exact)	To Find	Symbol
TEMPERATURE (exact)				
Celsius temperature	°C	$9/5$ (then add 32)	Fahrenheit temperature	°F



1. INTRODUCTION

This report presents data acquired from tests of a Perkins 247-CID diesel engine. The test results are sufficient to establish steady-state maps for engine performance, fuel consumption, and emission rates (carbon monoxide, unburned hydrocarbon, and oxides of nitrogen) over the entire operating range of the engine.

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

2. ENGINE TEST REPORT

General engine specifications for the Perkins 247-CID diesel engine are listed in table 1. A single batch of No. 2 diesel fuel was used throughout the breakin (table 2) and tests; an analysis of the fuel is given in table 3.

The engine breakin and tests were conducted with a new mean-tolerance engine mounted on a test stand and coupled to an eddy-current dynamometer. The engine was complete except for a fan (a cooling tower was used in place of the radiator). The alternator was used, but was not wired into the charging system.

The engine breakin consisted of 24 hours of operation at various speeds and loads. The total engine-operating time at the completion of testing was approximately 230 hours. The period of testing ran from 2 through 8 October 1975.

Test data were collected at the following steady-state modes:

Speeds: 1,200; 1,600; 1,900; 2,100; 2,400; 3,000; 3,600 rpm

Loads: 0, 5, 10, 25, 50, 75, 80, 90, 100 pct of full load
(repeated at 0, 5, 10, 25, 50, 75 pct of full load)

Idle speed loads: 0, 1, 2 bhp (repeated at 0 bhp)

Total number of test modes.....	68
Total number of repeats.....	45
Total number of tests.....	113

The following data were recorded for each test:

Test number

Date

Barometric pressure, mm Hg

Dew point, °F

Inlet air temperature, °F

Speed, rpm

Torque, lb-ft -- BLH strain gage; Daytronics indicator

Fuel rate, lb/hr -- FLO-TRON linear mass flowmeter

Throttle position -- deg

CO, ppm -- Beckman NDIR

CO₂, pct -- Beckman NDIR

HC, ppmC -- Custom built heated FID

NO_x, ppm -- Thermo-Electron chemiluminescent detector

Oil temperature, °F

Oil pressure, psi
 Coolant temperature, °F
 Exhaust temperature, °F
 Exhaust pressure, in. H₂O
 Smoke, pct opacity -- PHS smokemeter
 Airflow, lb/min -- Meriam laminar flow element.

The computed data include absolute humidity, power, exhaust flow rate, and emission rates of carbon monoxide (CO), unburned hydrocarbons (HC), and oxides of nitrogen (NO_x) in grams per hour. The following equations were applied in the computations:

$$H_2O \text{ (mm Hg)} = \exp \left[12.02 \left(\frac{\text{Dew pt. (}^\circ\text{F)} - 1.4}{\text{Dew pt. (}^\circ\text{F)} + 212} \right) \right],$$

$$\text{Humidity (grains H}_2\text{O/lb dry air)} = H = \frac{(4348)(H_2O)}{\text{Baro} - H_2O},$$

$$\text{Power (bhp)} = \left(\frac{\text{Speed} \times \text{Torque}}{5252} \right) \left(\frac{736.6}{\text{Baro} - H_2O} \right) \left(\frac{t_{\text{air}} + 460}{545} \right)^{0.7},$$

$$\text{Exhaust flow (lb/min)} = \text{Air flow (lb/min)} + \frac{\text{Fuel flow (lb/hr)}}{60},$$

$$\text{Mass CO} = \left(\begin{array}{c} \text{exhaust} \\ \text{flow} \\ \text{rate} \end{array} \right) \left(\begin{array}{c} \text{concentration} \\ \text{of} \\ \text{CO} \end{array} \right) \left(\frac{\text{Mol. Wt. of CO}}{\text{Mol. Wt. of exhaust}} \right) \left(\begin{array}{c} \text{correction} \\ \text{for water} \\ \text{removal} \end{array} \right),$$

$$\text{Mass CO} = 0.0263 \text{ (exhaust rate) (ppm CO)} \left[\frac{1}{1 + 0.03 \text{ CO}_2 \left(\frac{\text{CO} + \text{CO}_2}{\text{CO} + 3\text{CO}_2} \right)} \right],$$

$$\text{Mass HC} = 0.0132 \text{ (exhaust rate) (ppmC HC)},$$

$$\text{Mass NO}_x = 0.0432 \text{ (exhaust rate) (ppm NO}_x) \left[\frac{1}{1 + 0.03 \text{ CO}_2 \left(\frac{\text{CO} + \text{CO}_2}{\text{CO} + 3\text{CO}_2} \right)} \right] (K_H),$$

where K_H is the humidity correction factor, and

$$K_H = \frac{400}{475 - H}.$$

3. DISCUSSION OF TEST RESULTS

Brake horsepower, torque, and brake specific fuel consumption are shown plotted against engine speed (at full rack conditions) in figure 1. The maximum brake horsepower and peak torque values generally agree with those quoted in table 1. Fuel consumption rate was repeatable for various power output levels at a given speed (figure 2) and is nearly a linear function of power at any given engine speed. Emission rates of CO, HC, and NO_x as a function of power (figures 3 through 5) show relationships similar to those of other diesel engines equipped with the swirl combustion chamber and having high-speed capability. Exhaust-stream opacity showed higher levels of smoke when the engine was not producing any brake power (figure 6).

4. CONCLUSIONS

The repeatability of emission rates, fuel consumption, smoke levels, and engine performance was satisfactory for the purposes of these tests.

TABLE 1. MANUFACTURER'S ENGINE SPECIFICATIONS

Displacement, in.....	247.3
Maximum power, bhp @ 3,600 rpm.....	98
Maximum torque, ft-lb @ 2,100 rpm.....	164
Configuration.....	in-line 6 cylinder, vertical
Bore, in.....	3.622
Stroke, /in.....	4.00
Combustion system.....	swirl chamber
Compression ratio.....	21.0
Firing order.....	1-5-3-6-2-4
Injection pressure, psi.....	1,920
Injection timing, °BTDC.....	4
Block material.....	cast iron
Head material.....	cast iron
Number of crankshaft main bearings.....	7
Number of compression rings/piston.....	2
Number of oil rings/piston.....	1
Cam drive.....	gear
Engine weight, lb.....	850
Valve clearance (warm):	
Intake, in.....	0.012
Exhaust, in.....	0.012
Valve port size:	
Intake, in.....	1.45
Exhaust, in.....	1.24
Valve timing:	
Intake opens, °BTC.....	14
Intake closes, °ABC.....	44
Exhaust opens, °BBC.....	48
Exhaust closes, °ATC.....	10

TABLE 2. ENGINE BREAK-IN SCHEDULE

Engine speed, rpm	Torque, lb-ft	Time in mode, hr
1,400	14	1
1,800	14	1
1,800	28	2
2,200	28	2
2,200	43	2
2,500	43	2
2,500	57	2
2,900	57	2
2,900	71	2
3,100	71	2
3,100	85	2
3,200	85	1
3,200	99	1
3,400	99	1
3,600	114	1

TABLE 3. FUEL ANALYSIS

Fuel No.....	7558
Distillation, °F:	
10 pct evaporated.....	407
50 pct ".....	487
90 pct ".....	579
End point ".....	618
API gravity, deg.....	36
FIA analysis, pct:	
Aromatics.....	32
Olefins.....	4
Paraffins.....	64
Sulfur, pct.....	0.26

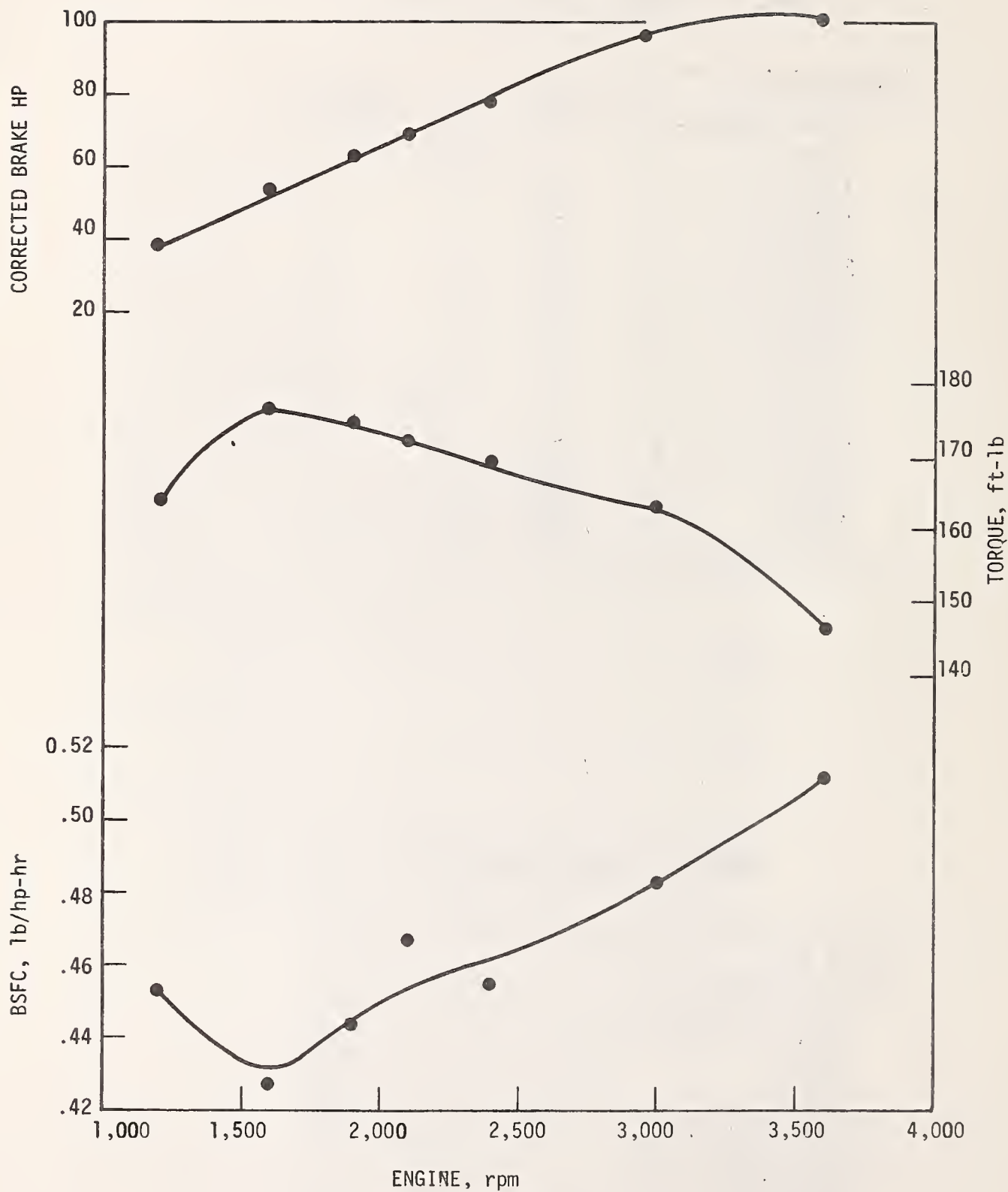


FIGURE 1. Brake Specific Fuel Consumption, Torque, and Brake Horsepower versus Engine rpm at Wide-Open Throttle--Perkins Diesel 247-CID Engine.

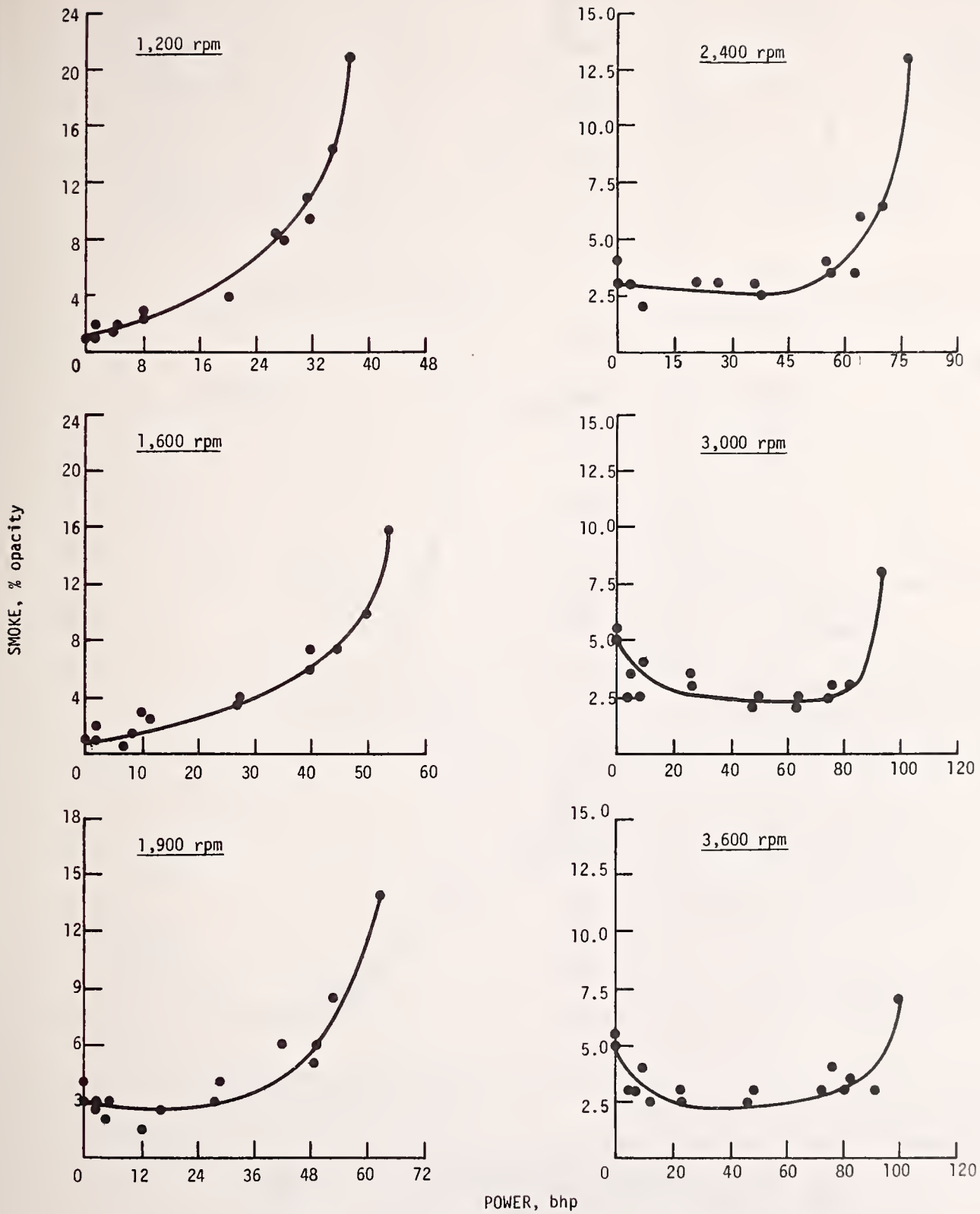


FIGURE 2. Emissions of Smoke versus Power at Various Speed and Load Conditions-- Perkins Diesel 247-CID Engine.

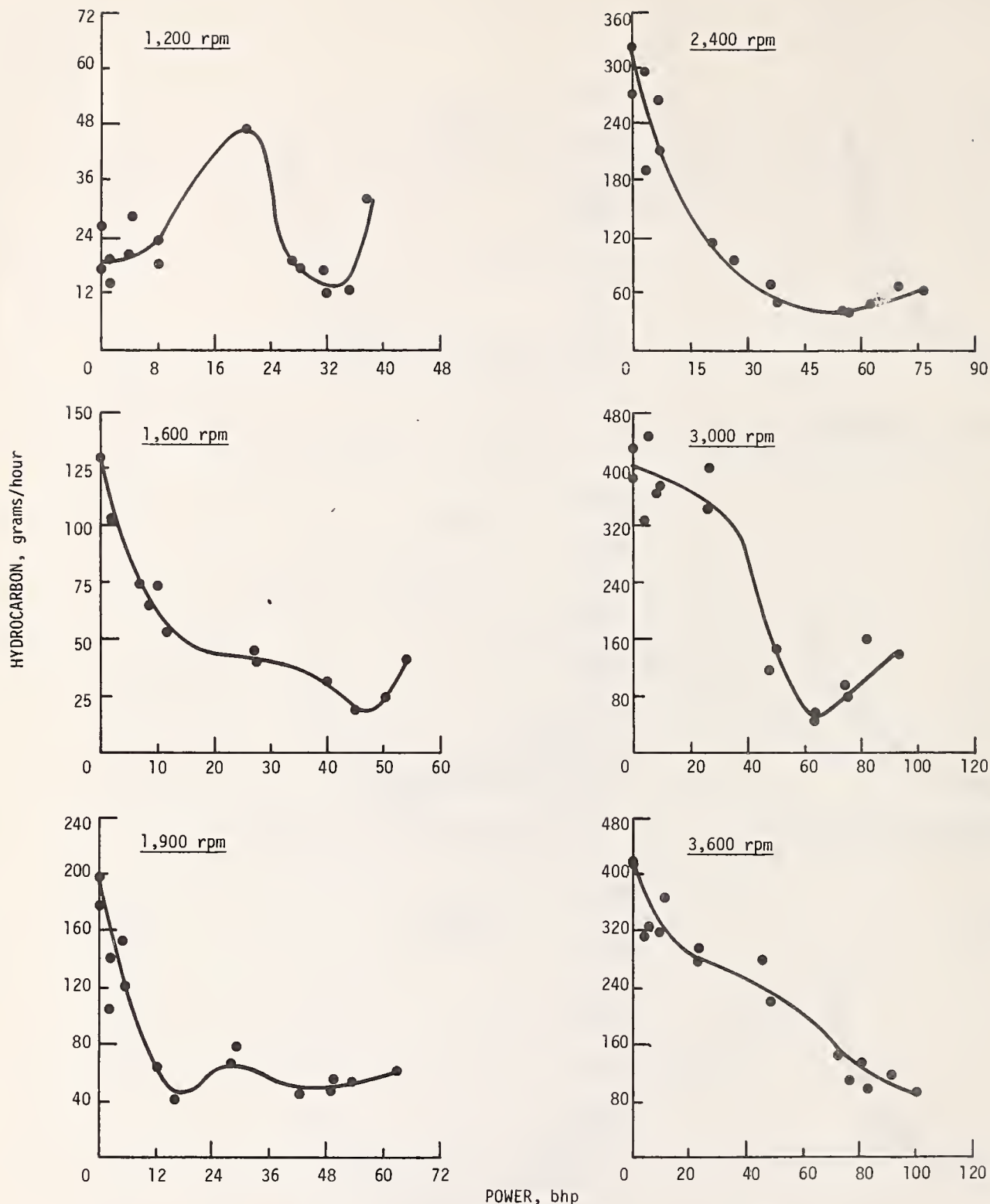


FIGURE 3. Hydrocarbon Emissions versus Power at Various Speed and Load Conditions-- Perkins Diesel 247-CID Engine.

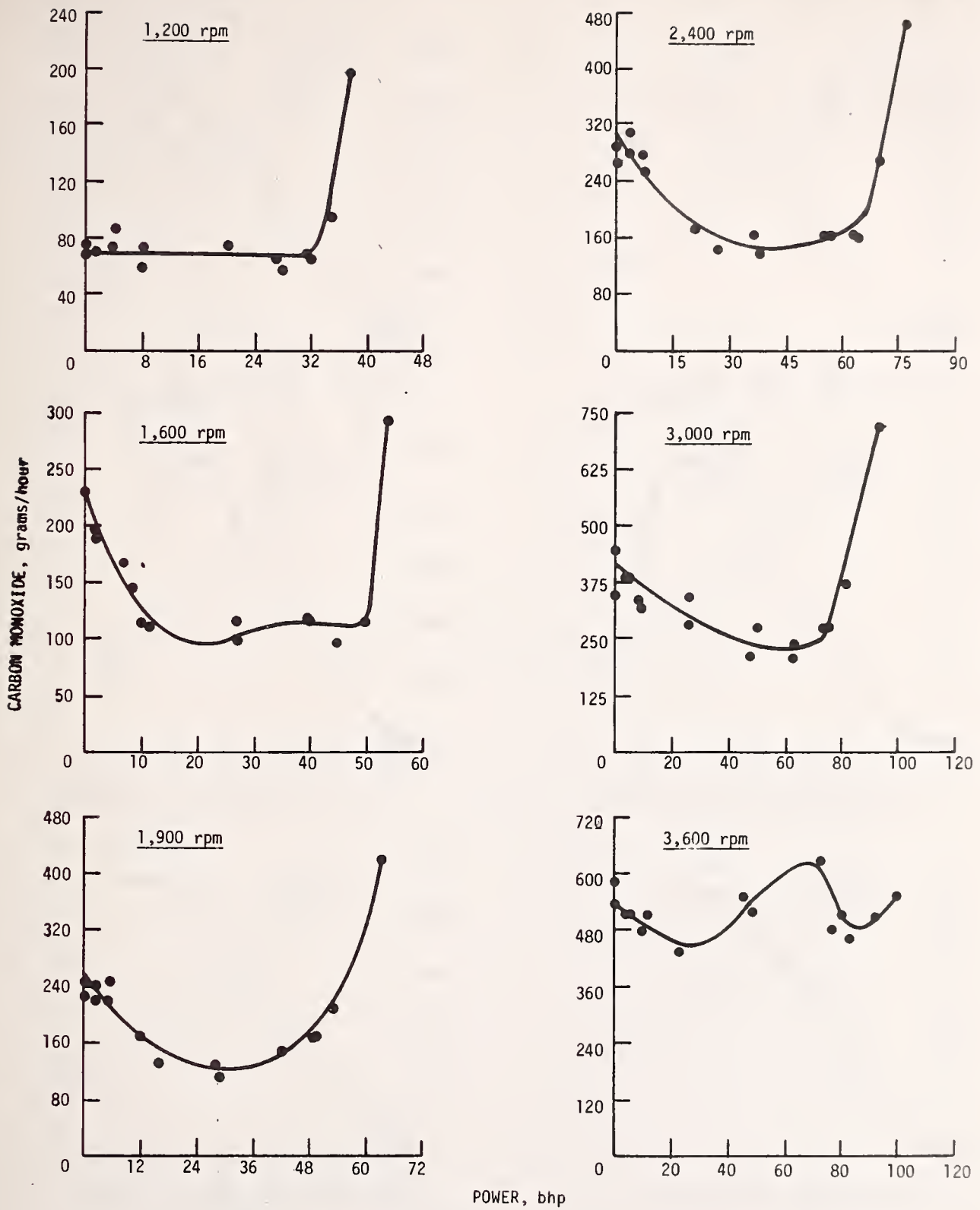


FIGURE 4. Carbon Monoxide Emissions versus Power at Various Speed and Load Conditions--Perkins Diesel 247-CID Engine.

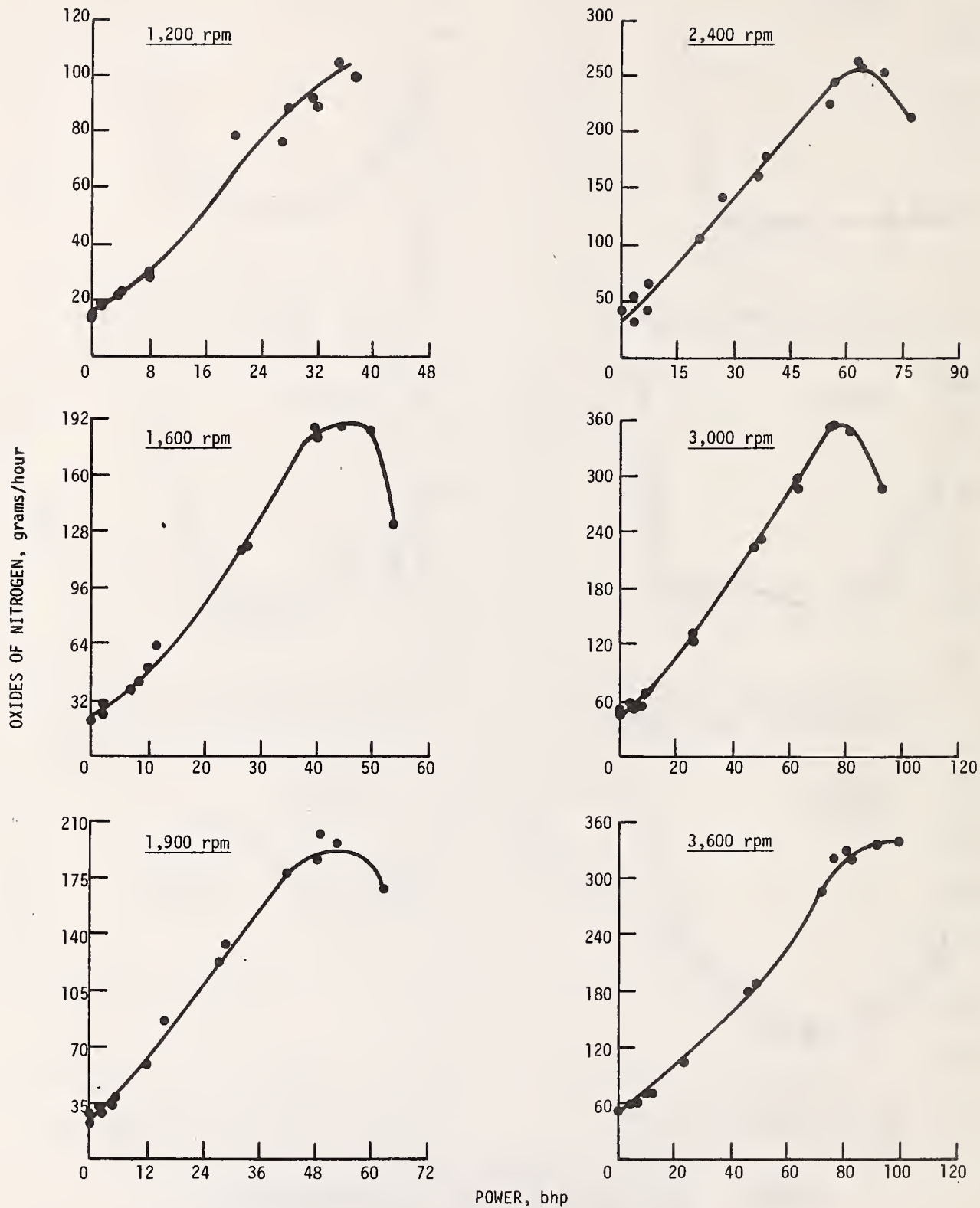


FIGURE 5. Oxides of Nitrogen Emissions versus Power at Various Speed and Load Conditions--Perkins Diesel 247-CID Engine.

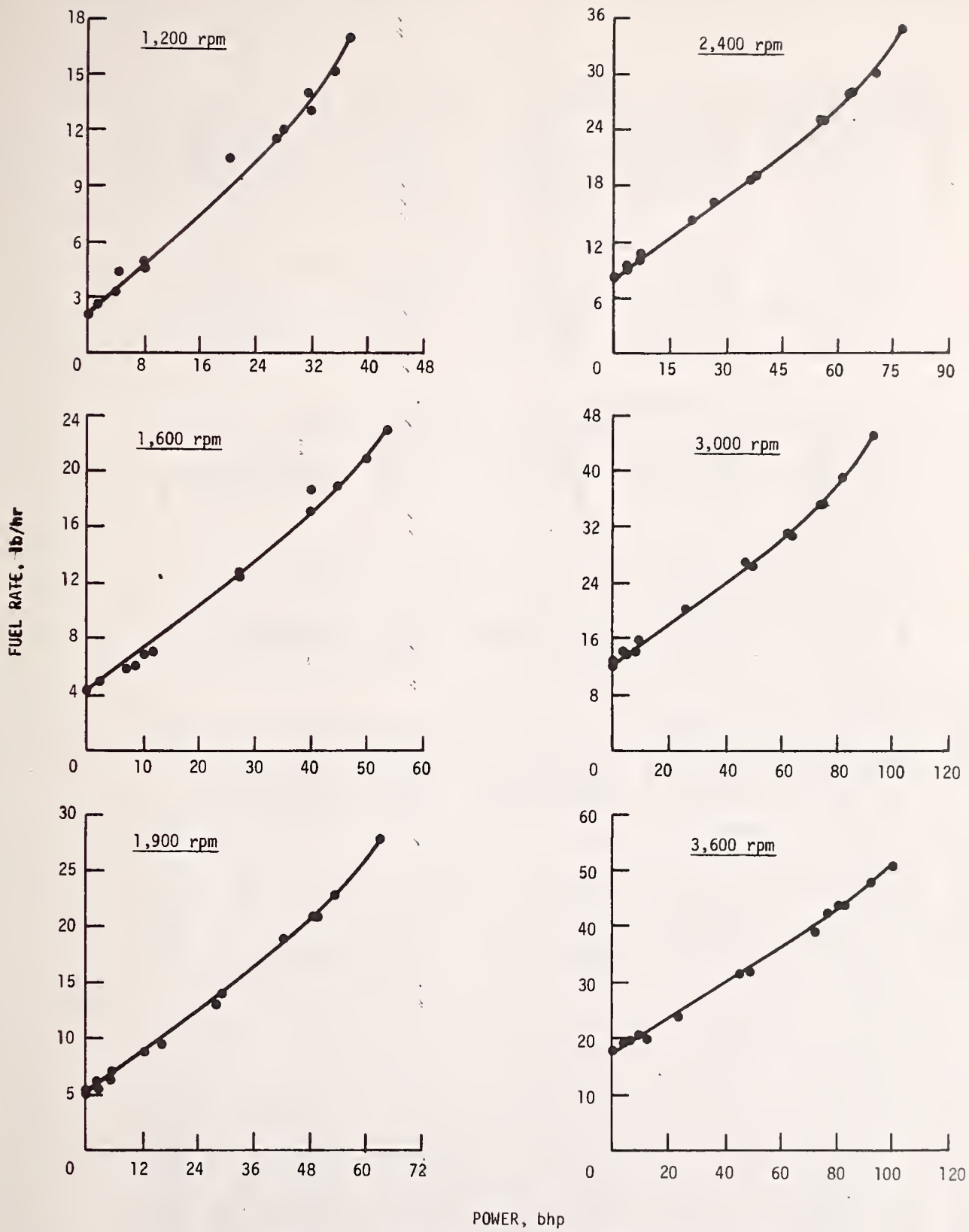


FIGURE 6. Fuel Rate versus Power at Various Speed and Load Conditions--Perkins Diesel 247-CID Engine.

Perkins diesel, 247-CID
7558

	1 10/ 8/75	2 10/ 8/75	3 10/ 8/75	4 10/ 8/75	5 10/ 8/75	6 10/ 2/75
Engine.....						
Fuel.....						
Test Number.....	741.4	741.4	741.4	741.4	741.4	755.5
Test Date.....	70	70	70	70	70	58
	86	84	84	89	87	88
Barometer, mm Hg.....						
Humidity, grains/lb.....	700	700	700	700	700	1200
Temperature, F.....	0.0	6.0	0.0	18.0	0.0	165.0
Engine speed, rpm.....	0.0	.8	0.0	2.4	0.0	37.5
Torque, lb-ft.....	1.5	1.8	1.5	1.0	1.5	17.0
Power, bhp*.....	0.0	0.0	0.0	0.0	0.0	26.0
Fuel rate, lb/hr.....						
Throttle angle, deg.....						
Concentrations, dry basis:						
CO, %.....	.0200	.0200	.0200	.0600	.0200	.1400
CO ₂ , %.....	2.47	2.74	2.97	2.32	2.21	10.17
O ₂ , %.....						
HC, ppmC.....	104	81	104	13	149	455
NOx, ppm.....	150	170	183	110	125	450
Emission rates, g/hr:						
CO.....	15.4	15.4	14.9	45.9	15.5	196.1
HC.....	4.0	3.1	3.9	.5	5.8	32.0
NOx**.....	18.7	21.3	22.1	13.7	15.7	99.4
Oil temperature, F.....	167	166	166	176	170	173
Oil pressure, psi.....	39	38	38	34	38	45
Coolant temperature, F.....	186	190	193	184	185	191
Exhaust temperature, F.....	214	215	227	308	217	930
Exhaust pressure, in H ₂ O.....	.4	.3	.3	.4	.4	17.0
Exhaust flow, lb/min.....	2.99	3.01	2.91	2.98	3.00	5.87
Smoke, % opacity.....	3.0	3.0	3.0	3.0	3.0	21.0

* Corrected - SAE J816b.
** Corrected for humidity.

Perkins diesel, 247-CID
7558

	7 10/ 7/75	8 10/ 6/75	9 10/ 8/75	11 10/ 8/75	12 10/ 6/75	13 10/ 7/75
Engine.....						
Fuel.....						
Test Number.....						
Test Date.....						
Barometer, mm Hg.....	746.0	746.9	741.4	741.4	746.9	746.0
Humidity, grains/lb.....	72	69	70	70	69	72
Temperature, F.....	88	89	86	82	89	87
Engine speed, rpm.....	1200	1200	1200	1200	1200	1200
Torque, lb-ft.....	151.5	138.0	135.7	121.9	116.8	88.2
Power, bhp*.....	35.0	31.8	31.4	28.1	26.9	20.3
Fuel rate, lb/hr.....	15.2	13.0	14.0	12.0	11.5	10.5
Throttle angle, deg.....	6.2	5.9	5.2	5.2	5.2	4.2
Concentrations, dry basis:						
CO, %.....	.0700	.0500	.0500	.0400	.0500	.0400
CO2, %.....	10.38	10.60	9.26	8.23	9.55	6.79
O2, %.....						
HC, ppmC.....	184	187	252	244	296	515
NOx, ppm.....	478	432	420	385	370	265
Emission rates, g/hr:						
CO.....	94.0	63.8	66.9	56.5	63.5	72.5
HC.....	12.4	12.0	16.9	17.3	18.9	46.9
NOx**.....	104.6	89.1	91.2	88.2	76.1	78.3
Oil temperature, F.....	178	180	174	167	190	182
Oil pressure, psi.....	44	43	45	45	42	44
Coolant temperature, F.....	191	191	190	191	191	191
Exhaust temperature, F.....	858	757	825	722	716	604
Exhaust pressure, in H2O.....	16.0	15.0	15.0	15.0	14.0	14.0
Exhaust flow, lb/min.....	5.64	5.36	5.56	5.81	5.29	7.37
Smoke, % opacity.....	14.5	9.5	11.0	8.0	8.5	4.0

* Corrected - SAE J816b.
** Corrected for humidity.

Perkins diesel, 247-CID
7558

	14 10/ 8/75	15 10/ 8/75	16 10/ 8/75	17 10/ 8/75	19 10/ 8/75	20 10/ 8/75
Engine.....	739.2	739.2	739.2	739.2	739.2	739.2
Fuel.....	83	83	83	83	83	83
Test Number.....	83	84	85	85	84	83
Test Date.....						
Barometer, mm Hg.....	1200	1200	1200	1200	1200	1200
Humidity, grains/lb.....	34.5	34.5	18.3	16.2	5.4	5.2
Temperature, F.....	8.0	8.0	4.3	3.8	1.3	1.2
Engine speed, rpm.....	4.8	4.5	4.3	3.2	2.5	2.5
Torque, lb-ft.....	2.9	2.9	2.2	2.2	2.0	2.0
Power, bhp.....						
Fuel rate, lb/hr.....						
Throttle angle, deg.....						
Concentrations, dry basis:						
CO, %.....	.0500	.0600	.0600	.0600	.0600	.0600
CO2, %.....	4.69	4.42	3.67	3.49	3.02	2.97
O2, %.....						
HC, ppmC.....	403	306	406	335	247	331
NOx, ppm.....	142	146	95	105	96	87
Emission rates, g/hr:						
CO.....	57.5	71.1	84.0	71.9	67.5	69.6
HC.....	23.3	18.2	28.5	20.2	14.0	19.2
NOx**.....	27.3	29.0	22.3	21.1	18.0	16.9
Oil temperature, F.....	169	170	167	168	169	167
Oil pressure, psi.....	43	43	44	45	43	43
Coolant temperature, F.....	188	187	191	188	192	188
Exhaust temperature, F.....	352	378	322	293	243	243
Exhaust pressure, in H2O.....	7.0	7.0	9.0	7.0	6.0	6.0
Exhaust flow, lb/min.....	4.58	4.71	5.52	4.72	4.41	4.54
Smoke, % opacity.....	2.5	3.0	2.0	1.5	1.0	2.0

* Corrected - SAE J816b.
** Corrected for humidity.

Perkins diesel, 247-CID
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Engine.....
Fuel.....

	21 10/ 8/75	22 10/ 8/75	23 10/ 2/75	24 10/ 9/75	25 10/ 9/75	26 10/ 9/75
Test Number.....						
Test Date.....						
Barometer, mm Hg.....	739.2	739.2	755.5	746.5	746.5	746.5
Humidity, grains/lb.....	83	83	58	68	68	68
Temperature, F.....	84	86	91	86	84	84
Engine speed, rpm.....	1200	1200	1600	1600	1600	1600
Torque, lb-ft.....	0.0	0.0	177.0	163.2	146.6	130.8
Power, bhp*.....	0.0	0.0	53.9	50.1	44.9	40.1
Fuel rate, lb/hr.....	2.0	2.1	23.0	21.0	19.0	17.2
Throttle angle, deg.....	1.9	1.8	26.0	6.4	6.1	6.0
Concentrations, dry basis:						
CO, %.....	.0600	.0600	.1700	.0600	.0500	.0600
CO2, %.....	2.53	2.53	11.28	10.07	9.35	8.59
O2, %.....						
HC, ppmC.....	309	424	467	247	193	313
NOx, ppm.....	76	64	480	595	605	580
Emission rates, g/hr:						
CO.....	67.0	73.7	294.8	115.6	95.5	116.3
HC.....	17.3	26.1	40.6	23.9	18.5	30.4
NOx**.....	14.1	13.1	131.3	185.3	186.8	181.7
Oil temperature, F.....	168	173	176	175	173	173
Oil pressure, psi.....	47	44	46	47	47	47
Coolant temperature, F.....	188	190	192	192	192	191
Exhaust temperature, F.....	225	242	1051	953	858	782
Exhaust pressure, in H2O.....	6.0	7.0	24.0	29.0	27.0	25.0
Exhaust flow, lb/min.....	4.35	4.79	7.34	8.07	7.94	8.00
Smoke, % opacity.....	1.0	1.0	16.0	10.0	7.5	7.5

* Corrected - SAE J816b.
** Corrected for humidity.

Perkins diesel, 247-CID
7558

	27 10/ 9/75	29 10/ 8/75	30 10/ 8/75	31 10/ 8/75	32 10/ 2/75	34 10/ 8/75
Engine.....						
Fuel.....						
Test Number.....	746.5	739.2	739.2	739.2	755.5	739.2
Test Date.....	10/ 9/75	10/ 8/75	10/ 8/75	10/ 8/75	10/ 2/75	10/ 8/75
Barometer, mm Hg.....	68	83	83	83	32	83
Humidity, grains/lb.....	81	83	83	86	81	86
Temperature, F.....						
Engine speed, rpm.....	1600	1600	1600	1600	1600	1600
Torque, lb-ft.....	130.6	88.1	87.1	37.4	34.1	27.3
Power, bhp*.....	39.9	27.3	27.0	11.6	10.2	8.5
Fuel rate, lb/hr.....	18.8	12.5	12.8	7.2	7.0	6.2
Throttle angle, deg.....	6.0	5.0	5.0	3.3	3.2	3.0
Concentrations, dry basis:						
CO, %.....	.0600	.0500	.0600	.0600	.0600	.0800
CO2, %.....	8.68	6.87	7.03	4.55	4.04	4.29
O2, %.....						
HC, ppmC.....	308	405	466	572	767	711
NOx, ppm.....	585	360	365	204	180	139
Emission rates, g/hr:						
CO.....	118.3	98.2	115.1	110.3	113.6	144.4
HC.....	30.4	39.9	44.8	52.8	72.9	64.4
NOx**.....	186.3	118.4	117.3	62.8	50.6	42.0
Oil temperature, F.....	163	173	171	175	169	175
Oil pressure, psi.....	47	47	47	47	47	47
Coolant temperature, F.....	192	189	190	190	190	190
Exhaust temperature, F.....	774	579	575	422	382	372
Exhaust pressure, in H2O....	25.0	20.0	20.0	15.0	15.0	14.0
Exhaust flow, lb/min.....	8.15	7.98	7.81	7.31	7.49	7.16
Smoke, % opacity.....	6.0	4.0	3.5	2.5	3.0	1.5

* Corrected - SAE J816b.
** Corrected for humidity.

Perkins diesel, 247-CID
7558

	35 10/ 8/75	37 10/ 8/75	38 10/ 8/75	39 10/ 8/75	40 10/ 2/75	41 10/ 7/75
Engine.....						
Fuel.....						
Test Number.....						
Test Date.....						
Barometer, mm Hg.....	739.2	739.2	739.2	739.2	755.5	746.0
Humidity, grains/lb.....	83	83	83	83	58	72
Temperature, F.....	85	83	82	83	92	87
Engine speed, rpm.....	1600	1600	1600	1600	1900	1900
Torque, lb-ft.....	22.1	6.6	6.4	0.0	174.0	145.5
Power, bhp*.....	6.9	2.0	2.0	0.0	63.1	53.3
Fuel rate, lb/hr.....	6.0	5.0	5.0	4.5	28.0	23.0
Throttle angle, deg.....	3.0	2.6	2.6	2.6	26.0	9.5
Concentrations, dry basis:						
CO, %.....	.0900	.1000	.1000	.1200	.2000	.1000
CO2, %.....	4.04	3.31	3.19	2.85	11.51	10.17
O2, %.....						
HC, ppmC.....	796	1044	1072	1344	583	505
NOx, ppm.....	122	90	75	62	505	575
Emission rates, g/hr:						
CO.....	167.3	196.5	189.9	230.3	419.2	208.7
HC.....	74.3	103.0	102.2	129.5	61.3	52.9
NOx**.....	38.0	29.6	23.9	19.8	166.9	195.5
Oil temperature, F.....	174	171	171	172	179	175
Oil pressure, psi.....	47	47	47	47	46	46
Coolant temperature, F.....	188	188	189	189	192	190
Exhaust temperature, F.....	348	292	294	272	1119	979
Exhaust pressure, in H2O.....	15.0	15.0	15.0	15.0	31.0	33.0
Exhaust flow, lb/min.....	7.36	7.72	7.46	7.51	8.90	8.75
Smoke, % opacity.....	.5	2.0	1.0	1.0	14.0	8.5

* Corrected - SAE J816b.
** Corrected for humidity.

Perkins diesel, 247-CID
7558

	42 10/ 8/75	43 10/ 6/75	45 10/ 6/75	46 10/ 7/75	47 10/ 6/75	48 10/ 8/75
Engine.....						
Fuel.....						
Test Number.....						
Test Date.....						
Barometer, mm Hg.....	741.4	746.9	746.9	746.0	748.3	739.2
Humidity, grains/lb.....	70	69	69	72	69	83
Temperature, F.....	85	88	87	85	87	83
Engine speed, rpm.....	1900	1900	1900	1900	1900	1900
Torque, lb-ft.....	135.0	133.5	115.8	79.5	76.0	43.5
Power, bhp*.....	49.6	48.9	42.3	29.0	27.7	16.0
Fuel rate, lb/hr.....	21.0	21.0	19.0	14.0	13.0	9.5
Throttle angle, deg.....	9.3	9.2	8.7	7.6	7.6	6.0
Concentrations, dry basis:						
CO, %.....	.0800	.0800	.0700	.0500	.0600	.0600
CO2, %.....	9.06	10.55	9.55	6.40	7.20	5.02
O2, %.....						
HC, ppmC.....	518	446	416	699	619	373
NOx, ppm.....	585	548	520	370	355	238
Emission rates, g/hr:						
CO.....	169.3	167.7	147.0	110.1	126.9	128.4
HC.....	55.0	46.9	43.9	77.3	65.7	40.1
NOx**.....	200.9	185.8	176.7	132.8	121.4	85.3
Oil temperature, F.....	175	178	179	178	178	175
Oil pressure, psi.....	47	47	47	47	47	47
Coolant temperature, F.....	191	193	191	190	190	190
Exhaust temperature, F.....	905	897	820	641	609	470
Exhaust pressure, in H2O.....	32.0	34.0	30.0	24.0	24.0	20.0
Exhaust flow, lb/min.....	8.78	8.81	8.75	8.91	8.62	8.55
Smoke, % opacity.....	6.0	5.0	6.0	4.0	3.0	2.5

* Corrected - SAE J816b.
** Corrected for humidity.

Perkins diesel, 247-CID
7558

	49 10/ 8/75	54 10/ 7/75	55 10/ 6/75	56 10/ 6/75	57 10/ 7/75	58 10/ 2/75
Engine.....						
Fuel.....						
Test Number.....						
Test Date.....						
Barometer, mm Hg.....	739.2	746.0	748.3	748.3	746.0	754.5
Humidity, grains/lb.....	83	72	70	70	72	70
Temperature, F.....	86	84	85	82	84	82
Engine speed, rpm.....	1900	1900	1900	1900	1900	1900
Torque, lb-ft.....	32.8	14.8	12.9	6.8	6.0	0.0
Power, bhp*.....	12.1	5.4	4.7	2.4	2.2	0.0
Fuel rate, lb/hr.....	8.8	7.0	6.3	5.5	6.0	5.2
Throttle angle, deg.....	6.3	5.8	5.5	5.4	5.4	5.2
Concentrations, dry basis:						
CO, %.....	.0800	.1100	.1000	.1000	.1100	.1000
CO2, %.....	7.45	3.67	3.92	3.43	3.14	2.85
O2, %.....						
HC, ppmC.....	593	1084	1399	1282	957	1769
NOx, ppm.....	167	105	94	84	91	76
Emission rates, g/hr:						
CO.....	167.1	243.6	218.3	217.6	239.3	223.3
HC.....	62.2	120.5	153.2	140.1	104.5	198.3
NOx**.....	58.4	37.9	33.1	29.4	32.1	27.6
Oil temperature, F.....	179	184	181	173	179	174
Oil pressure, psi.....	47	45	46	47	45	47
Coolant temperature, F.....	188	190	189	188	189	187
Exhaust temperature, F.....	434	385	354	326	345	422
Exhaust pressure, in H2O.....	20.0	20.0	21.0	20.0	19.0	20.0
Exhaust flow, lb/min.....	8.54	8.73	8.63	8.56	8.54	8.74
Smoke, % opacity.....	1.5	3.0	2.0	3.0	2.5	4.0

* Corrected - SAE J816b.
** Corrected for humidity.

Perkins diesel, 247-CID
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	59	60	61	62	63	64
Test Number.....	10/ 2/75	10/ 2/75	10/ 7/75	10/ 8/75	10/ 7/75	10/ 8/75
Test Date.....						
Barometer, mm Hg.....	754.5	755.5	746.0	741.4	746.0	741.4
Humidity, grains/lb.....	70	58	72	70	72	70
Temperature, F.....	82	92	87	86	83	83
Engine speed, rpm.....	1900	2100	2100	2100	2100	2100
Torque, lb-ft.....	0.0	171.0	151.2	135.8	133.0	121.5
Power, bhp*.....	0.0	68.7	61.3	55.3	53.6	49.3
Fuel rate, lb/hr.....	5.0	32.0	26.5	24.0	24.0	21.5
Throttle angle, deg.....	5.3	26.0	12.1	11.7	11.6	9.4
Concentrations, dry basis:						
CO, %.....	.1100	.1900	.1100	.0800	.0700	.0600
CO2, %.....	2.74	11.51	10.28	8.97	9.26	8.50
O2, %.....						
HC, ppmC.....	1595	735	690	516	412	721
NOx, ppm.....	62	515	585	585	585	562
Emission rates, g/hr:						
CO.....	244.0	462.0	268.6	196.7	173.2	148.5
HC.....	177.6	89.6	84.5	63.6	51.2	89.5
NOx**.....	22.3	197.5	232.8	233.4	235.9	225.8
Oil temperature, F.....	173	183	180	180	180	179
Oil pressure, psi.....	47	47	46	47	47	47
Coolant temperature, F.....	187	193	192	192	191	192
Exhaust temperature, F.....	296	1169	1008	940	908	840
Exhaust pressure, in H2O....	19.0	37.0	42.0	40.0	42.0	38.0
Exhaust flow, lb/min.....	8.67	10.32	10.25	10.19	10.28	10.21
Smoke, % opacity.....	3.0	13.0	8.0	6.0	4.0	4.0

* Corrected - SAE J816b.
** Corrected for humidity.

Perkins diesel, 247-CID
7558

Engine.....
Fuel.....

	65	66	67	68	69	74
Test Number.....	10/ 6/75	10/ 6/75	10/ 7/75	10/ 8/75	10/ 2/75	10/ 6/75
Test Date.....						
Barometer, mm Hg.....	746.9	748.3	746.0	739.2	755.5	748.3
Humidity, grains/lb.....	69	69	72	83	70	70
Temperature, F.....	87	87	85	86	82	84
Engine speed, rpm.....	2100	2100	2100	2100	2100	2100
Torque, lb-ft.....	119.2	80.2	79.4	52.5	49.5	15.6
Power, bhp*.....	48.2	32.4	32.1	21.5	19.7	6.3
Fuel rate, lb/hr.....	21.3	15.5	16.0	12.0	12.5	8.2
Throttle angle, deg.....	11.3	10.0	10.0	9.4	9.3	8.4
Concentrations, dry basis:						
CO, %.....	.0600	.0500	.0500	.0600	.0500	.1000
CO2, %.....	9.55	7.20	6.40	5.23	4.82	4.04
O2, %.....						
HC, ppmC.....	359	346	293	287	433	1621
NOx, ppm.....	508	345	375	275	255	90
Emission rates, g/hr:						
CO.....	144.7	123.9	125.6	148.2	129.1	251.6
HC.....	43.5	43.1	36.9	35.6	56.1	204.7
NOx**.....	198.2	138.3	153.5	113.7	106.9	36.7
Oil temperature, F.....	181	181	179	179	175	179
Oil pressure, psi.....	47	47	47	47	47	47
Coolant temperature, F.....	192	190	190	189	190	190
Exhaust temperature, F.....	841	641	658	496	490	381
Exhaust pressure, in H2O.....	48.0	32.0	31.0	27.0	29.0	26.0
Exhaust flow, lb/min.....	10.05	10.11	10.16	9.88	10.30	9.96
Smoke, % opacity.....	4.5	2.0	3.0	3.0	3.0	3.0

* Corrected - SAE J816b.
** Corrected for humidity.

Perkins diesel, 247-CID
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	15 10/ 7/75	76 10/ 6/75	77 10/ 7/75	78 10/ 2/75	79 10/ 2/75	80 10/ 2/75
Engine.....						
Fuel.....						
Test Number.....						
Test Date.....						
Barometer, mm Hg.....	746.0	748.3	746.0	754.5	754.5	755.5
Humidity, grains/lb.....	72	70	72	70	70	58
Temperature, F.....	83	82	82	81	82	99
Engine speed, rpm.....	2100	2100	2100	2100	2100	2400
Torque, lb-ft.....	13.8	8.7	6.2	0.0	0.0	168.0
Power, bhp*.....	5.6	3.5	2.5	0.0	0.0	77.1
Fuel rate, lb/hr.....	8.2	7.3	7.2	6.2	6.3	35.0
Throttle angle, deg.....	8.3	8.2	8.1	8.0	8.0	26.0
Concentrations, dry basis:						
CO, %.....	.1000	.1000	.1100	.1000	.1000	.1700
CO2, %.....	3.67	3.57	3.31	2.85	2.97	11.30
O2, %.....						
HC, ppmC.....	1219	1669	924	1631	1923	453
NOx, ppm.....	115	90	115	72	78	495
Emission rates, g/hr:						
CO.....	253.2	256.7	279.9	255.1	256.7	466.2
HC.....	154.9	215.0	118.1	208.9	247.7	62.4
NOx**.....	47.5	37.4	47.7	29.8	32.3	214.1
Oil temperature, F.....	179	177	170	176	178	192
Oil pressure, psi.....	48	50	49	49	50	48
Coolant temperature, F.....	190	190	188	188	188	193
Exhaust temperature, F.....	404	342	333	303	432	1218
Exhaust pressure, in H2O.....	26.0	26.0	24.0	25.0	25.0	46.0
Exhaust flow, lb/min.....	9.99	10.11	10.00	9.98	10.06	11.62
Smoke, % opacity.....	3.0	3.0	2.5	3.5	4.0	13.0

* Corrected - SAE J816b.
** Corrected for humidity.

Perkins diesel, 247-CID
7558

Engine.....
Fuel.....

	81 10/ 7/75	82 10/ 8/75	83 10/ 7/75	84 10/ 8/75	85 10/ 6/75	86 10/ 7/75
Test Number.....	746.0	741.4	746.0	741.4	746.9	746.0
Test Date.....	72 88	70 89	72 85	70 84	69 87	72 85
Barometer, mm Hg.....						
Humidity, grains/lb.....						
Temperature, F.....						
Engine speed, rpm.....	2400	2400	2400	2400	2400	2400
Torque, lb-ft.....	151.3	137.3	136.1	122.0	119.9	82.4
Power, bhp*.....	70.3	64.2	63.0	56.7	55.5	38.1
Fuel rate, lb/hr.....	30.0	28.0	28.0	25.0	25.0	19.0
Throttle angle, deg.....	14.6	14.4	14.4	14.0	14.0	13.0
Concentrations, dry basis:						
CO, %.....	.1000	.0600	.0600	.0600	.0600	.0500
CO2, %.....	10.38	9.35	9.55	8.68	9.76	6.56
O2, %.....						
HC, ppmC.....	494	370	348	294	306	361
NOx, ppm.....	575	590	585	548	508	395
Emission rates, g/hr:						
CO.....	271.4	161.8	166.0	165.6	164.7	138.3
HC.....	67.2	50.0	48.4	40.7	42.2	50.2
NOx**.....	254.3	258.2	263.7	245.5	225.6	178.1
Oil temperature, F.....	184	191	184	183	185	183
Oil pressure, psi.....	48	46	47	49	49	49
Coolant temperature, F.....	193	193	192	192	192	192
Exhaust temperature, F.....	1092	1076	997	984	880	791
Exhaust pressure, in H2O.....	55.0	54.0	53.0	50.0	49.0	42.0
Exhaust flow, lb/min.....	11.40	11.21	11.53	11.41	11.46	11.21
Smoke, % opacity.....	6.5	6.0	3.5	3.5	4.0	2.5

* Corrected - SAE J816b.
** Corrected for humidity.

Perkins diesel, 247-CID
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	87 10/ 6/75	89 10/ 2/75	90 10/ 2/75	94 10/ 7/75	95 10/ 6/75	96 10/ 7/75
Engine.....						
Fuel.....						
Test Number.....						
Test Date.....						
Barometer, mm Hg.....	748.3	755.5	755.5	746.0	748.3	746.0
Humidity, grains/lb.....	69	70	70	72	69	72
Temperature, F.....	86	82	85	83	84	82
Engine speed, rpm.....	2400	2400	2400	2400	2400	2400
Torque, lb-ft.....	79.3	58.7	45.4	15.4	14.9	7.7
Power, bhp*.....	36.6	26.7	20.8	7.1	6.9	3.5
Fuel rate, lb/hr.....	18.5	16.0	14.0	10.5	9.8	9.2
Throttle angle, deg.....	13.0	12.5	12.2	11.4	11.4	11.2
Concentrations, dry basis:						
CO, %.....	.0600	.0500	.0600	.0900	.1000	.1100
CO2, %.....	7.53	5.37	5.09	3.92	4.23	3.55
O2, %.....						
HC, ppmC.....	507	665	792	1501	1900	1341
NOx, ppm.....	360	300	225	138	90	115
Emission rates, g/hr:						
CO.....	166.2	144.7	172.4	254.7	280.6	313.0
HC.....	70.4	96.6	114.2	213.3	267.6	191.5
NOx**.....	161.3	140.9	104.9	63.6	40.9	53.3
Oil temperature, F.....	181	179	186	175	183	179
Oil pressure, psi.....	50	50	49	50	48	49
Coolant temperature, F.....	191	192	189	190	190	190
Exhaust temperature, F.....	742	604	566	449	419	401
Exhaust pressure, in H2O.....	42.0	39.0	37.0	32.0	0.0	31.0
Exhaust flow, lb/min.....	11.33	11.60	11.49	11.19	11.13	11.21
Smoke, % opacity.....	3.0	3.0	3.0	2.0	2.0	3.0

* Corrected - SAE J816b.
** Corrected for humidity.

Perkins diesel, 247-CID
7558

Engine.....
Fuel.....

	97 10/ 6/75	98 10/ 2/75	99 10/ 2/75	111 10/ 2/75	112 10/ 7/75	113 10/ 7/75
Test Number.....						
Test Date.....						
Barometer, mm Hg.....	748.3	754.5	754.5	755.5	746.0	746.0
Humidity, grains/lb.....	70	70	70	58	72	72
Temperature, F.....	82	81	83	99	88	86
Engine speed, rpm.....	2400	2400	2400	3000	3000	3000
Torque, lb-ft.....	7.2	0.0	0.0	160.1	140.5	130.1
Power, bhp*.....	3.3	0.0	0.0	93.2	81.9	75.6
Fuel rate, lb/hr.....	8.8	8.0	8.0	45.0	39.0	35.0
Throttle angle, deg.....	11.2	11.0	11.0	26.0	19.6	19.5
Concentrations, dry basis:						
CO, %.....	.1000	.0900	.1000	.2100	.1100	.0800
CO2, %.....	3.79	3.08	3.19	11.05	10.60	9.76
O2, %.....						
HC, ppmC.....	2112	1831	2213	794	942	473
NOx, ppm.....	64	82	85	530	632	640
Emission rates, g/hr:						
CO.....	281.2	267.8	290.6	720.6	372.2	272.4
HC.....	298.1	273.4	322.8	136.7	159.9	80.9
NOx**.....	29.2	39.6	39.9	286.8	348.4	355.1
Oil temperature, F.....	180	179	182	201	193	191
Oil pressure, psi.....	50	50	50	52	52	53
Coolant temperature, F.....	189	189	188	194	193	192
Exhaust temperature, F.....	485	358	423	1306	1137	1027
Exhaust pressure, in H2O.....	32.0	32.0	33.0	69.0	87.0	83.0
Exhaust flow, lb/min.....	11.10	11.67	11.41	14.51	14.24	14.22
Smoke, % opacity.....	3.0	3.0	4.0	8.0	3.0	3.0

* Corrected - SAE J816b.
** Corrected for humidity.

Perkins diesel, 247-CID
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	114 10/ 8/75	115 10/ 6/75	116 10/ 8/75	117 10/ 8/75	118 10/ 2/75	121 10/ 2/75
Engine.....						
Fuel.....						
Test Number.....	114	115	116	117	118	121
Test Date.....	10/ 8/75	10/ 6/75	10/ 8/75	10/ 8/75	10/ 2/75	10/ 2/75
Barometer, mm Hg.....	741.4	746.9	741.4	739.2	755.5	754.5
Humidity, grains/lb.....	70	69	70	83	70	70
Temperature, F.....	87	87	84	88	84	83
Engine speed, rpm.....	3000	3000	3000	3000	3000	3000
Torque, lb-ft.....	126.8	109.4	108.0	84.6	82.8	45.3
Power, bhp*.....	74.2	63.6	63.0	49.9	47.5	26.0
Fuel rate, lb/hr.....	35.0	30.5	31.0	26.2	26.7	20.0
Throttle angle, deg.....	19.6	18.8	19.0	18.4	18.3	17.5
Concentrations, dry basis:						
CO, %.....	.0800	.0700	.0600	.0800	.0600	.0800
CO2, %.....	9.45	9.76	8.23	7.70	6.56	5.51
O2, %.....						
HC, ppmC.....	555	320	269	842	655	1967
NOx, ppm.....	640	520	530	405	390	230
Emission rates, g/hr:						
CO.....	271.5	238.1	206.9	273.1	211.0	279.6
HC.....	94.6	54.6	46.5	144.2	115.5	345.0
NOx**.....	352.6	286.2	296.7	231.6	222.5	130.5
Oil temperature, F.....	190	194	191	195	192	191
Oil pressure, psi.....	50	53	54	54	53	53
Coolant temperature, F.....	192	192	193	191	193	191
Exhaust temperature, F.....	1063	930	954	836	785	630
Exhaust pressure, in H2O.....	80.0	77.0	73.0	66.0	69.0	58.0
Exhaust flow, lb/min.....	14.13	14.20	14.20	13.99	14.25	14.03
Smoke, % opacity.....	2.5	2.5	2.0	2.5	2.0	3.5

* Corrected - SAE J816b.
** Corrected for humidity.

Perkins diesel, 247-CID
7558

Engine.....
Fuel.....

	122 10/ 8/75	123 10/ 7/75	124 10/ 6/75	125 10/ 6/75	126 10/ 7/75	127 10/ 2/75
Test Number.....						
Test Date.....						
Barometer, mm Hg.....	739.2	746.0	748.3	748.3	746.0	754.5
Humidity, grains/lb.....	83	72	69	70	72	70
Temperature, F.....	85	83	85	84	83	81
Engine speed, rpm.....	3000	3000	3000	3000	3000	3000
Torque, lb-ft.....	45.0	15.4	13.4	8.3	6.0	0.0
Power, bhp*.....	26.4	8.9	7.8	4.8	3.5	0.0
Fuel rate, lb/hr.....	20.0	15.5	14.0	13.5	13.8	12.0
Throttle angle, deg.....	17.5	16.9	16.9	16.7	16.6	16.5
Concentrations, dry basis:						
CO, %.....	.1000	.0900	.1000	.1100	.1100	.1000
CO2, %.....	6.10	4.42	4.82	4.42	4.04	3.55
O2, %.....						
HC, ppmC.....	2335	2117	2177	2545	1862	2243
NOx, ppm.....	212	117	100	91	98	80
Emission rates, g/hr:						
CO.....	344.0	317.7	336.3	384.8	386.5	344.6
HC.....	403.0	375.1	367.5	446.9	328.2	388.0
NOx**.....	122.1	67.3	54.4	51.3	56.1	44.7
Oil temperature, F.....	192	189	191	192	189	189
Oil pressure, psi.....	50	50	49	50	50	53
Coolant temperature, F.....	191	190	191	190	190	189
Exhaust temperature, F.....	628	512	496	467	449	438
Exhaust pressure, in H2O.....	55.0	52.0	51.0	51.0	50.0	48.0
Exhaust flow, lb/min.....	13.88	14.03	13.41	13.90	13.91	13.58
Smoke, % opacity.....	3.0	4.0	2.5	3.5	2.5	5.0

* Corrected - SAE J816b.
** Corrected for humidity.

Perkins diesel, 247-CID
7558

	128 10/ 2/75	140 10/ 2/75	141 10/ 7/75	142 10/ 8/75	143 10/ 7/75	144 10/ 2/75
Engine.....						
Fuel.....						
Test Number.....						
Test Date.....						
Barometer, mm Hg.....	754.5	755.5	746.0	739.2	746.0	755.5
Humidity, grains/lb.....	70	58	72	83	72	70
Temperature, F.....	82	90	90	93	87	89
Engine speed, rpm.....	3000	3600	3600	3600	3600	3600
Torque, lb-ft.....	0.0	144.0	130.5	115.9	115.5	110.0
Power, bhp*.....	0.0	99.9	91.8	82.8	80.9	76.4
Fuel rate, lb/hr.....	12.4	51.0	48.0	44.0	44.0	42.5
Throttle angle, deg.....	16.5	26.0	25.2	24.6	24.8	24.5
Concentrations, dry basis:						
CO, %.....	1250	1400	1300	1200	1300	1200
CO2, %.....	3.67	10.83	11.05	10.38	10.17	9.55
O2, %.....						
HC, ppmC.....	2408	465	599	499	677	550
NOx, ppm.....	83	545	530	495	515	500
Emission rates, g/hr:						
CO.....	444.9	552.3	507.1	463.1	510.7	476.2
HC.....	430.2	92.0	117.3	96.7	133.5	109.6
NOx**.....	48.0	339.1	336.9	319.9	329.7	322.0
Oil temperature, F.....	192	199	203	206	202	203
Oil pressure, psi.....	53	53	52	52	53	54
Coolant temperature, F.....	190	195	194	193	193	194
Exhaust temperature, F.....	427	1350	1286	1220	1193	1156
Exhaust pressure, in H2O.....	50.0	94.0	123.0	113.0	116.0	116.0
Exhaust flow, lb/min.....	14.04	16.64	16.48	16.21	16.47	16.54
Smoke, % opacity.....	5.5	7.0	3.0	3.5	3.0	4.0

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Perkins diesel, 247-CID
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Engine.....
Fuel.....

	145 10/ 8/75	149 10/ 7/75	150 10/ 6/75	153 10/ 6/75	154 10/ 7/75	155 10/ 6/75
Test Number.....						
Test Date.....						
Barometer, mm Hg.....	741.4	746.0	748.3	748.3	746.0	748.3
Humidity, grains/lb.....	70	72	69	69	72	69
Temperature, F.....	86	86	85	86	84	86
Engine speed, rpm.....	3600	3600	3600	3600	3600	3600
Torque, lb-ft.....	102.6	69.4	66.4	33.0	32.8	16.6
Power, bhp*.....	72.2	48.6	46.3	23.0	22.9	11.6
Fuel rate, lb/hr.....	39.0	32.0	31.5	24.0	24.0	20.0
Throttle angle, deg.....	24.3	24.0	24.0	23.5	23.5	23.0
Concentrations, dry basis:						
CO, %.....	.1600	.1300	.1400	.1100	.1100	.1300
CO2, %.....	9.35	7.36	8.59	6.87	5.95	5.95
O2, %.....						
HC, ppmC.....	740	1111	1428	1506	1405	1876
NOx, ppm.....	450	290	282	160	160	110
Emission rates, g/hr:						
CO.....	626.2	517.7	548.0	433.0	436.7	511.0
HC.....	145.4	222.1	280.6	297.5	279.9	370.1
NOx**.....	285.9	188.2	178.6	101.9	103.5	69.9
Oil temperature, F.....	201	192	190	201	196	201
Oil pressure, psi.....	53	54	55	58	49	53
Coolant temperature, F.....	193	192	193	192	192	192
Exhaust temperature, F.....	1124	959	900	756	773	695
Exhaust pressure, in H2O.....	107.0	95.0	96.0	83.0	80.0	77.0
Exhaust flow, lb/min.....	16.29	16.27	16.18	16.01	16.00	15.85
Smoke, % opacity.....	3.0	3.0	2.5	2.5	3.0	2.5

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Perkins diesel, 247-CID
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Engine.....	156	157	158	159	160
Fuel.....	10/ 7/75	10/ 6/75	10/ 7/75	10/ 2/75	10/ 2/75
Test Number.....	746.0	748.3	746.0	754.5	754.5
Test Date.....	72	70	72	70	70
Barometer, mm Hg.....	85	85	84	83	84
Humidity, grains/lb.....	3600	3600	3600	3600	3600
Temperature, F.....	13.5	8.4	6.0	0.0	0.0
Engine speed, rpm.....	9.4	5.9	4.2	0.0	0.0
Torque, lb-ft.....	20.5	19.3	19.0	18.0	18.0
Power, bhp*.....	22.8	22.5	22.4	22.0	22.0
Fuel rate, lb/hr.....					
Throttle angle, deg.....					
Concentrations, dry basis:					
CO, %.....	.1200	.1300	.1300	.1400	.1300
CO2, %.....	5.09	5.51	4.89	4.42	4.55
O2, %.....	1609	1666	1584	2007	2044
HC, ppmC.....	108	94	91	75	78
NOx, ppm.....					
Emission rates, g/hr:					
CO.....	474.4	511.5	512.9	579.9	534.3
HC.....	319.3	329.1	313.7	417.2	421.6
NOx**.....	69.6	59.9	58.2	50.4	51.7
Oil temperature, F.....	199	196	200	199	200
Oil pressure, psi.....	48	54	53	53	53
Coolant temperature, F.....	191	192	191	191	191
Exhaust temperature, F.....	698	657	651	610	610
Exhaust pressure, in H2O.....	75.0	76.0	72.0	73.0	73.0
Exhaust flow, lb/min.....	15.81	15.80	15.75	16.46	16.35
Smoke, % opacity.....	4.0	3.0	3.0	5.5	5.0

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