CRC Report No. 566

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

DAAK-70-89-C-0022

August 1989

COORDINATING RESEARCH COUNCIL, INC.
219 PERIMETER CENTER PARKWAY, ATLANTA, GEORGIA 30346

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1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

(CRC PROJECT No. CM-123-88)

Prepared by the

1988 Analysis Panel

of the

CRC Octane Number Requirement Survey Group

August 1989

Automotive Vehicle Fuel, Lubricant, and Equipment Research Committee

of the

Coordinating Research Council, Inc.

ABSTRACT

An annual statistical survey of octane number requirements of current model vehicles is conducted by the Coordinating Research Council, Inc. Test data have been obtained by nineteen companies on 391 1988 vehicles including passenger cars and light-duty trucks and vans, of which 155 were equipped with knock sensors. Maximum octane number requirements were determined by testing at maximum-throttle conditions, as well as at part-throttle, with three unleaded fuel series of varying sensitivities. Requirements are expressed as the (R+M)/2 octane number, Research octane number, and Motor octane number of the reference fuel producing knock which was recurrent and repeatable at the lowest audible level. Estimated octane number requirements for the total vehicles are weighted in proportion to the 1988 vehicle model production and/or sales figures. The maximum octane number requirements of 1988 models with average sensitivity unleaded fuels were 84.7 (R+M)/2 octane numbers at the 50 percent satisfaction level, and 89.3 (R+M)/2 octane numbers at the 90 percent satisfaction level. Comparison with previous Surveys are made in this report.

TABLE OF CONTENTS

TEXT

TABLES

1988 Total Vehicles

TABLE OF CONTENTS - (Continued)

TABLE OF CONTENTS - (Continued)

FIGURES

APPENDICES

I. INTRODUCTION

This is the forty-second annual statistical survey of octane requirements of current model vehicles conducted by the Coordinating Research Council, Inc. This Survey studies distributions of vehicle octane requirements as a function cf satisfaction levels and fuel sensitivity in a sample representative of 1988 model vehicles. Distributions of vehicle octane requirements are estimated from these data. The effect of fuel sensitivity, which is the difference between Research octane number (RON) and Motor octane number (MON), is investigated by using two full-boiling range fuels series and the primary reference fuel series. This is done because vehicles do not respond to RON and MON in the same way.

Knock sensors enable engines to adapt to fuels of varying octane numbers which can result in lowest audible knock occurring over a range of octane numbers. The high and low ends of this range are determined for each knock-sensor-equipped vehicle and the effect of these two octane requirements on the distribution is calculated.

The data in this Survey are obtained by trained raters under controlled conditions. For some vehicles, information on the owner's perception of vehicle knock and the owner's current choice of gasoline octane are available. A comparison between the trained rater's and customer's report of knock on tank fuel is presented, and trends are shown.

Nineteen companies participated in this Survey; they are listed in Appendix A. Members of the CRC Octane Number Requirement Survey Analysis Panel are identified in Appendix B.

II. SUMMARY

Octane number requirements were determined on 391 1988 model year vehicles, including 305 passenger cars and 86 light-duty trucks and vans. One hundred fifty-five of the test vehicles were equipped with knock sensors. Estimated octane number requirements for the vehicle population are weighted in proportion to the 1988 vehicle model production and/or sales data. Maximum octane number requirements for the 1988 models and changes from 1987 for the four weighted vehicle population groups at the 50 percent and 90 percent levels using FBRU (full-boiling range unleaded) fuels are summarized below:

FBRU (R+M)/2 OCTANE NUMBER REQUIREMENTS

1988 AND CHANGES FROM 1987

Weighted Population	KS-H**	from 1987	KS-L***	from 1987
50% Satisfaction				
Total Vehicles (39.6%)*	84.7	-1.0	84.0	-1.4
Total Cars (39.0%)*	84.7	-0.7	84.2	-0.9
Total Trucks (41.9%)*	84.8	-1.5	83.8	-2.0
Total Knock-Sensor Vehicles	85.0	-1.6	83.0	-2.5
90% Satisfaction				
Total Vehicles (39.6%)*	89.3	-1.2	88.6	-1.2
Total Cars (39.0%)*	89.2	-1.2	88.7	-1.2
Total Trucks (41.9%)*	89.6	-2.0	88.6	-1.4
Total Knock-Sensor Vehicles	90.2	-1.7	88.6	-1.3

* Knock sensor-equipped vehicles as percent of the associated population.

** KS-H = Population with knock sensor-equipped vehicles at maximum (high-borderline) requirement.

*** KS-L = Population with knock sensor-equipped vehicles at minimum (low-borderline) requirement.

Maximum octane number requirements of the total 1988 vehicle population decreased by 1.0 (R+M)/2 at 50 percent satisfaction and 1.2 (R+M)/2 at 90 percent satisfaction compared with 1987 on FBRU fuels. Maximum octane requirements of 1988 knock-sensor vehicles decreased by 1.6 (R+M)/2 at 50 percent and by 1.7 (R+M)/2 at 90 percent satisfaction compared with 1987.

Maximum (high-borderline) and minimum (low-borderline) octane number requirements were determined for knock-sensor-equipped vehicles. For the 1988 knock-sensor vehicle population, minimum octane number requirements were 2.0 (R+M)/2 lower than the maximum requirements at the 50 percent satisfaction level and 1.6 (R+M)/2 lower than the maximum requirements at the 90 percent level. At current market penetration levels, inclusion of the knock-sensor-equipped vehicles at their minimum (low-borderline) requirement reduced by 0.7 (R+M)/2 at both the 50 percent level and 90 percent satisfaction levels the total vehicle population requirements relative to those calculated at their maximum (high-borderline) requirements.

Part-throttle octane requirements were equal to or higher than the maximum-throttle octane requirements on 31 percent of all 1988 vehicles with FBRU fuels (119 of 382 vehicles). This compares with 29 percent of all 1987 vehicles with part-throttle requirement on FBRU fuels.

In the 1988 Survey, 31 percent of the vehicles tested knocked on tank fuel, which compares with 35 percent in the 1987 Survey.

The 1988 Survey included sufficient data for eight specific models to be analyzed separately as select models. All select models had automatic transmissions, and four were equipped with knock sensors. Maximum octane requirements for the select models at the 50 percent and 90 percent satisfaction levels for FBRU fuels are summarized in the following table.

SELECT MODELS

MAXIMUM FBRU OCTANE NUMBER REQUIREMENTS

Select Model	No. Tested	(R+M)/2 50% Sat.	(R+M)/2 90% Sat.
NAR T25A3/HAR T25A3/IAR T25A3/ LAR T25A3	18	88.4	93.8
NAW P28A3/NLW P28A3/HAW P28A3/ IAW P28A3/LAW P28A3 (High Borderline)	17	85.3	90.7
NAW P28A3/NLW P28A3/HAW P28A3/ IAW P28A3/LAW P28A3 (Low Borderline)	17	82.9	87.9
NAW P28A4/HWW P28A4/IWW P28A4/ LAW P28A4/LWW P28A4 (High Borderline)	19	83.2	88.9
NAW P28A4/HWW P28A4/IWW P28A4/ LAW P28A4/LWW P28A4 (Low Borderline)	18	81.7	85.5
HHC P38A4/ICC P38A4/IHC P38A4/ LHC P38A4 (High Borderline)	13	79.6	84.0
HHC P38A4/ICC P38A4/IHC P38A4/ LHC P38A4 (Low Borderline)	13	78.6	82.0
MC5 P16A3	11	82.6	86.5
ODU P30A4/MDU P30A4 (High Borderline)	18	88.3	91.9
ODU P30A4/MDU P30A4 (Low Borderline)	16	86.7	91.1
OPF P50A4/OSF P50A4/MPF P50A4/ SPF P50A4	12	85.3	89.0
PKD T22A3/KPD T22A3	11	82.9	85.3

III. TEST VEHICLES

This year's Survey tested a total of 391 1988 model vehicles, compared with 389 vehicles in the 1987 Survey. The analysis of the data included 305 passenger cars and 86 vans and light-duty trucks. Also included are 155 knock sensor-equipped vehicles (119 cars and 36 trucks).

Beginning with the 1987 Survey, test vehicles are divided into four main categories:

(1) Total Vehicles, which includes all US and imported passenger cars, vans, and light-duty trucks

(2) Total Cars, which includes all US and imported passenger cars

(3) Total Trucks, which includes all US and imported vans and light-duty trucks

(4) Total Knock-Sensor Vehicles, which includes all knock sensor equipped US and imported passenger cars, vans, and light-duty trucks.

In the 1988 Survey, 82 percent of the transmissions were automatic. Forty-eight percent of the automatics were three-speeds, and the rest four-speeds. The manual transmissions were divided into 14 percent four-speeds and 86 percent five-speeds. Ninety-two percent of the surveyed vehicles were air-conditioned.

The select models shown in Table 1 are not the same as the select models appearing in the program proposal (Table D-I of Appendix D). Three of the models shown in the program are not included in Table 1 because fewer than 10 vehicles per model were tested. Although not appearing as select models in the program proposal, three of the models in Table 1 are included as select models because sufficient data on these models were collected.

Table 2 shows the distribution of odometer mileage for both the 1988 and 1987 Surveys. The 1988 distribution is shown as a bar chart in Figure 1. The average odometer mileage was 12,407. Four vehicles with odometer mileages less than 6,000 miles were included in the analysis. The weighted average displacement in 1988 was 3.01 liters, compared with 2.91 in 1987. The weighted average compression ratio in 1988 was 9.02 compared with 8.98 in 1987. Trends in the sales-weighted average compression ratio, engine displacement, and knock-sensor penetration for the US vehicle population over the five model years are shown below. Also included are the percent of vehicles tested in this Survey which have automatic transmissions and air conditioners.

Average Vehicle Parameters

Model Year	Sales Weighted Displacement (liters)	Sales Weighted Compression Ratio	Sales Weighted Knock Sensor	Percent of Vehicles Tested Automatic Transmissions	Percent of Vehicles Tested Air Conditioners
1988	3.0	9.0	39.6	82	92
1987	2.9	9.0	35.0	81	89
1986	3.0	9.0	35.5	84	94
1985	3.2	8.8	27.5	84	92
1984	3.1	8.7	13.8	83	91

The basic timing was adjusted to the manufacturer's recommended setting (within ±1°) prior to testing. A total of thirty-three vehicles were adjusted; thirty-one were two or more degrees off from the manufacturer's setting. The number of vehicles and their deviation in spark setting are shown in Table 3.

Participants were requested to rate specific vehicle models in a pattern which would minimize data bias due to differences among testing laboratories and vehicles. To accomplish this, the United States and Canada were was divided into four geographical areas, and companies within each geographical area were requested to test specific vehicles.

IV. REFERENCE FUELS

Three series of reference fuels were used in the 1988 Survey:

- Primary Reference (PR) Fuels;
- Average Sensitivity Full-Boiling Range Unleaded (FBRU) Reference Fuels with sensitivities similar to those of normal commercial gasoline; and
- High-Sensitivity Full-Boiling Range Unleaded (FBRSU) Reference Fuels with sensitivities about two octane numbers higher than the FBRU fuels.

The FBRU and FBRSU reference fuels are the same fuels as were used in the 1987 Survey

A. PR Fuels

Isooctane and normal heptane, meeting ASTM specifications, were blended in two octane number increments from 76 to 82 octane numbers, and in one octane number increments from 82 to 100 octane numbers.

B. FBRU Reference Fuels

FBRU fuels were prepared from three base blends (RMFD-362-87/88, RMFD-363-87/88, and RMFD-364-87/88) in two octane number increments from 80 to 84 RON, and in one octane number increments from 84 to 103 RON. The base blends were prepared from normal refinery components. Inspection data furnished by the supplier are shown in Appendix C, Table C-1. The composition and average laboratory octane data for the 1987/1988 FBRU reference fuel series are presented in Appendix C, Table C-2

C. FBRSU Reference Fuels

FBRSU fuels were prepared from three base blends (RMFD-365-87/88 RMFD-366-87/88, and RMFD-367-87/88) in two octane number increments from 80 to 84 RON, and in one octane number increments from 84 to 102.8 RON. The base blends were prepared from normal refinery components. Inspection data furnished by the supplier are shown in Appendix C, Table C-3. The laboratory blending octane data for the 1987/1988 FBRSU reference fuels are presented in Table C-4.

V. TEST TECHNIQUE

The test technique (CRC Designation E-15-88, Attachment 2 of Appendix D specified that octane number requirements be determined at level road acceleration conditions. The order of fuel testing was tank fuel, FBRSU fuels, FBRU fuels, and PR fuels. Knocking tendencies were investigated using both maximum-throttle and part-throttle acceleration techniques.* Part-throttle was investigated in each vehicle to determine if the part-throttle requirement was higher or equal to the maximum-throttle requirement. In these cases, the part-throttle requirement search was conducted with all three fuels. Part-throttle requirements were also determined with FBRU fuels down to four Research octane numbers below the maximum requirement at maximum-throttle.

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* Maximum-throttle is either full-throttle for manual transmissions or widest throttle position (detent) that does not cause the transmission to downshift for automatic transmissions.

The maximum octane number requirement of a vehicle is defined as the octane number of the highest octane test fuel producing borderline knock. This requirement is defined at either maximum- or part-throttle acceleration conditions. For vehicles equipped with knock sensors, the technique identifies the highest octane fuel that gives borderline knock (maximum or high-borderline requirement) and the lowest octane fuel that gives borderline knock (minimum or low-borderline requirement). Requirements are expressed as the (R+M)/2 octane number, Research octane number (RON), and Motor octane number (MON) of the reference fuel which produces knock that is recurrent and repeatable at the lowest audible level.

Of the nineteen laboratories participating in the 1988 Survey, four used level roads and fifteen used chassis dynamometers. Seventy-six percent of the cars were tested on chassis dynamometers.

Average test temperature was 70°F, with a barometric pressure average of 29.84 inches Hg and average humidity of 56.9 grains per pound. Test conditions for individual observations are reported in Appendix E.

The table below shows the average test conditions and the average odometer readings for the last five Surveys.

Average Ambient Test Conditions

Year	Temperature, F°	Barometric Pressure, inches Hg	Humidity, grains per pound	Mileage
1984	70	29.86	61.0	11374
1985	69	29.91	56.6	12343
1986	70	29.83	58.2	11849
1987	67	29.85	48.8	13720
1988	70	29.84	56.9	12407

There is general agreement that ambient temperature, pressure, and humidity can influence the octane number requirement of a vehicle at any time.[1,2] Octane requirement increases as temperature and pressure increase, and as humidity decreases. The coefficients of these effects are difficult to determine and may be dependent upon the vehicle. In the 1987 Survey, the average humidity was significantly lower than in other years. Directionally, this would cause the results of this Octane Number Requirement Survey to be slightly higher (about 0.3 octane number) than would be the case in other Surveys.

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(1) B. D. Keller, J. H. Steury, T. O. Wagner, SAE Paper 780668 (1978)

(2) H. A, Bigley, Jr., B. D. Keller and M. G. Kloppe, SAE Paper 710675 (1971).

(3) CRC Project No. CM-124-85/86

VI. DISCUSSION OF RESULTS

A. Distribution of Maximum Octane Number Requirements

The octane number requirement data were used to prepare satisfaction curves and tables for the following samples of 1988 model vehicles:

(1) Total Vehicles,
(2) Total Cars,
(3) Total Trucks and Vans, and
(4) Total Knock-Sensor Vehicles.

Maximum (R+M)/2, RON, and MON requirements and 95 percent confidence limits for the four categories at 50 percent and 90 percent satisfaction are shown in Table 4. In preparing the curves and tables, the octane number requirement data were weighted in accordance with final 1988 model-year production and/or sales figures. Each curve and table, therefore, provides an estimate of the distribution of octane number requirements of the appropriate vehicle population on the road. The procedure for assigning weighting factors and for calculating the octane number requirement distributions is described in Appendix F.

Vehicles equipped with knock sensors were included in the 1988 models tested. All vehicles with knock sensors were tested for maximum (high-borderline) octane number requirements, and 141 of the 155 vehicles were tested for minimum (low-borderline) octane number requirements. Octane number requirement distributions were calculated for each group of vehicles using the requirements from those vehicles with knock sensors rated at maximum (high-borderline) requirement and with their ratings at minimum (low-borderline) requirement. Maximum octane number requirements for the 1988 model vehicles were considered to be the requirements which included the knock sensor-equipped vehicles at the maximum (high-borderline) requirement.

Requirements are expressed as the (R+M)/2, Research, and Motor octane numbers of the reference fuel which produced knock that was recurrent and repeatable at the lowest audible level.

Round-off techniques have been changed from previous Surveys. A description of this change is included in Appendix F.

1. Total Vehicles

In the 1988 Survey, maximum octane number requirements were determined on 390 vehicles with PR fuels, and 391 vehicles with FBRU and FBRSU fuels. One hundred fifty-five of the vehicles were equipped with knock sensors.

Maximum (R+M)/2 octane number requirements for all three reference fuels are shown in Figures 2, 3, and 4. Each plot compares two distributions of maximum octane requirements for total vehicles. One distribution includes knock-sensor vehicles at their maximum (high-borderline) requirement; the other includes knock-sensor vehicles at their minimum (low-borderline) requirement. The maximum (R+M)/2 octane number requirements for all three reference fuels are plotted in Figure 5. The octane number requirement distributions for FBRU and FBRSU fuels are similar. Maximum (R+M)/2, Research, and Motor octane number requirements are listed in Table 5. The 50 percent and 90 percent satisfaction level requirements are:

MAXIMUM OCTANE NUMBER REQUIREMENTS

(Total Vehicles)

Fuel	50% Satisfied			90% Satisfied		
	(R+M)/2	RON	MON	(R+M)/2	RON	MON
PR	87.4	87.4	87.4	92.9	92.9	92.9
FBRU	84.7	88.6	80.8	89.3	94.3	84.4
FBRSU	84.7	89.9	79.4	89.8	95.9	83.7

Differences between 1988 and 1987 Survey maximum (R+M)/2, Research, and Motor octane number requirements are also shown in Tables 5 and 6 for all three fuel series. Distributions of the 1988 and 1987 maximum (R+M)/2 requirements are shown in Figure 6 for FBRU fuels. The differences at the 50 percent and 90 percent satisfaction levels are:

DIFFERENCES BETWEEN 1988 AND 1987 MAXIMUM OCTANE NUMBER REQUIREMENTS

(Total Vehicles)

Fuel	50% Satisfied			90% Satisfied		
	(R+M)/2	RON	MON	(R+M)/2	RON	MON
PR	-0.5	-0.5	-0.5	-0.6	-0.6	-0.6
FBRU	-1.0	-1.2	-0.8	-1.2	-1.3	-0.9
FBRSU	-0.8	-1.0	-0.7	-1.3	-1.5	-1.1

Octane number requirements with knock-sensor-equipped vehicles tested at minimum (low-borderline) levels, along with differences between the 1988 and 1987 octane number requirments, are given in Table 6.

Confidence limits for maximum octane number requirement distributions are given in Appendix G, Table G-1. The 95 percent confidence limits for (R+M)/2 octane number requirements were $\pm$0.4 at the 50 percent satisfaction level, and $\pm$0.5 to $\pm$0.6 at the 90 percent satisfaction level.

2. Total Cars

Maximum octane number requirements were determined on 304 cars with PR fuels, and 305 cars with FBRU and FBRSU fuels.

Maximum (R+M)/2, RON, and MON requirements on all three fuel series are given in Table 7. The maximum (R+M)/2 octane number requirement distributions for all three reference fuels are plotted in Figure 7. Maximum octane number requirements at the 50 percent and 90 percent satisfaction levels are:

MAXIMUM OCTANE NUMBER REQUIREMENTS

(Total Cars)

	50% Satisfied			90% Satisfied		
Fuel	(R+M)/2	RON	MON	(R+M)/2	RON	MON
PR	87.1	87.1	87.1	92.5	92.5	92.5
FBRU	84.7	88.6	80.8	89.2	94.2	84.3
FBRSU	84.5	89.7	79.3	89.8	95.9	83.7

Differences between the 1988 and 1987 Survey maximum (R+M)/2, RON, and MON requirements are also shown in Tables 7 for PR, FBRU, and FBRSU fuels. Differences between 1988 and 1987 data at the 50 percent and 90 percent satisfaction levels are:

DIFFERENCES BETWEEN 1988 AND 1987 MAXIMUM OCTANE NUMBER REQUIREMENTS

(Total Cars)

	50% Satisfied			90% Satisfied		
Fuel	(R+M)/2	RON	MON	(R+M)/2	RON	MON
PR	-0.3	-0.3	-0.3	-0.6	-0.6	-0.6
FBRU	-0.7	-0.8	-0.5	-1.2	-1.3	-0.9
FBRSU	-0.7	-0.8	-0.6	-0.9	-1.1	-0.8

Octane number requirements with knock-sensor-equipped cars tested at minimum (low-borderline) levels, along with differences between the 1988 and 1987 octane number requirments, are given in Table 8.

Confidence limits for maximum octane number requirement distributions of 1988 total cars are given in Appendix G, Table G-1. The 95 percent confidence limits for (R+M)/2 requirements varied from $\pm$0.4 to $\pm$0.5 at the 50 percent satisfaction level, and from $\pm$0.6 to $\pm$0.7 at the 90 percent satisfaction level.

3. Total Trucks and Vans

Maximum octane number requirements were determined on 86 trucks and vans with PR, FBRU, and FBRSU fuels. Maximum (R+M)/2 octane number requirements for all three reference fuel series are plotted in Figure 8. Maximum octane number requirements in terms of (R+M)/2, RON, and MON are given in Table 9. The 50 percent and 90 percent satisfaction level maximum octane number requirements are:

MAXIMUM OCTANE NUMBER REQUIREMENTS

(Total Trucks and Vans)

	50% Satisfied			90% Satisfied		
Fuel	(R+M)/2	RON	MON	(R+M)/2	RON	MON
PR	88.0	88.0	88.0	93.7	93.7	93.7
FBRU	84.8	88.7	80.9	89.6	94.6	84.6
FBRSU	85.0	90.3	79.7	89.8	95.9	83.7

Differences between the maximum (R+M)/2, RON, and MON requirements of trucks and vans in the 1988 and 1987 Surveys are also given in Table 9 for all three fuel series. The differences at the 50 percent and 90 percent satisfaction levels are:

DIFFERENCES BETWEEN 1988 AND 1987 MAXIMUM OCTANE NUMBER REQUIREMENTS

(Total Trucks and Vans)

	50% Satisfied			90% Satisfied		
Fuel	(R+M)/2	RON	MON	(R+M)/2	RON	MON
PR	-1.2	-1.2	-1.2	-0.3	-0.3	-0.3
FBRU	-1.5	-1.8	-1.1	-2.0	-2.4	-1.7
FBRSU	-1.0	-1.2	-0.9	-2.4	-2.6	-2.1

Octane number requirements with knock-sensor-equipped trucks and vans tested at minimum (low-borderline) levels, along with the differences between the 1988 and 1987 octane number requirements, are given in Table 10.

Confidence limits for maximum octane number requirement distributions of 1988 trucks and vans are tabulated in Appendix G, Table G-1. The 95 percent confidence limits for (R+M)/2 octane number requirements varied from $\pm$0.7 to $\pm$1.0 at the 50 percent satisfaction level, and from $\pm$0.9 to $\pm$1.3 at the 90 percent satisfaction level.

4. Total Knock-Sensor Vehicles

Maximum octane number requirements (high-borderline) were determined on 155 total vehicles containing knock sensors on PR, FBRU, and FBRSU fuels. Minimum (low-borderline) octane number requirements were determined on 141 vehicles.

The distributions of maximum (R+M)/2 octane number requirements at the maximum (high-borderline) and the minimum (low-borderline) levels are shown in Figures 9 and 10, respectively, for the three fuel series. Maximum (R+M)/2, RON, and MON requirements for all three fuel series are given in Table 11. Maximum octane number requirements for the 50 percent and 90 percent satisfaction levels are:

MAXIMUM OCTANE NUMBER REQUIREMENTS

(Total Knock-Sensor Vehicles)

	50% Satisfied			90% Satisfied		
Fuel	(R+M)/2	RON	MON	(R+M)/2	RON	MON
PR	87.9	87.9	87.9	93.4	93.4	93.4
FBRU	85.0	89.0	81.1	90.2	95.3	85.1
FBRSU	85.2	90.6	79.9	90.3	96.5	84.1

Differences between 1988 and 1987 Survey maximum (R+M)/2, RON, and MON requirements are also shown in Tables 11. Distributions of maximum (R+M)/2 octane number requirements are shown in Figure 11 for FBRU fuels. The differences at the 50 percent and 90 percent satisfaction levels are:

DIFFERENCES BETWEEN 1988 AND 1987 MAXIMUM OCTANE NUMBER REQUIREMENTS

(Total Knock-Sensor Vehicles)

	50% Satisfied			90% Satisfied		
Fuel	(R+M)/2	RON	MON	(R+M)/2	RON	MON
PR	-1.2	-1.2	-1.2	-1.2	-1.2	-1.2
FBRU	-1.6	-1.9	-1.1	-1.7	-2.0	-1.4
FBRSU	-0.9	-1.0	-0.7	-2.3	-2.5	-2.1

Octane number requirements with knock-sensor-equipped vehicles tested at minimum (low-borderline) levels, along with the differences between the 1988 and 1987 octane number requirements, are given in Table 12.

The differences between the maximum octane number requirements of 155 vehicles tested, and the octane number requirements at minimum (low-borderline) levels of 141 vehicles are:

DIFFERENCES BETWEEN MAXIMUM AND MINIMUM OCTANE NUMBER REQUIREMENTS

(Total Knock-Sensor Vehicles)

Fuel	50% Satisfied (R+M)/2	50% Satisfied RON	50% Satisfied MON	90% Satisfied (R+M)/2	90% Satisfied RON	90% Satisfied MON
PR	2.8	2.8	2.8	1.2	1.2	1.2
FBRU	2.0	2.4	1.7	1.6	1.9	1.3
FBRSU	2.5	3.0	2.1	1.8	2.1	1.6

Confidence limits for maximum octane number requirement distributions of 1988 knock-sensor vehicles are given in Appendix G, Table G-1. The 95 percent confidence limits for (R+M)/2 octane number requirements (high-borderline) varied between $\pm$0.7 and $\pm$0.8 at the 50 percent satisfaction level, and between $\pm$0.9 and $\pm$1.0 at the 90 percent satisfaction level.

The 95 percent confidence limits for (R+M)/2 octane number requirements (low-borderline) varied between $\pm$0.8 and $\pm$0.9 at the 50 percent satisfaction level, and between $\pm$1.0 and $\pm$1.2 at the 90 percent satisfaction level.

B. Maximum Octane Number Requirement Trends

Trends over the last five years in the sales-weighted maximum octane number requirements of the four vehicle categories analyzed in this report are given below.

FBRU (R+M)/2 MAXIMUM OCTANE NUMBER REQUIREMENTS

1984 TO 1988

Weighted Population	1988	1987	1986	1985	1984
50% Satisfaction					
Total Vehicles	84.7	85.7	85.3	86.4	86.7
Total Cars	84.7	85.4	85.0	86.2	86.9
Total Trucks	84.8	86.3	86.9		
Total Knock-Sensor Vehicles	85.0	86.6	85.4	86.7	86.5
90% Satisfaction					
Total Vehicles	89.3	90.5	89.8	90.1	91.1
Total Cars	89.2	90.4	89.5	90.0	90.9
Total Trucks	89.6	91.6	90.3		
Total Knock-Sensor Vehicles	90.2	91.9	90.2	91.5	90.7

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*The total trucks octane number requirements for 1986 were estimated from the percent satisfaction distributions for total vehicles and total cars.

C. Part-Throttle Requirements

Part-throttle octane requirements were equal to or higher than the maximum-throttle octane requirements on 31 percent of all 1988 vehicles with FBRU fuels (119 of 382 vehicles). This compares with 29 percent in 1987.

D. Select Models

Eight select models, representing eight engine-transmission-chassis combinations, were tested. The select models tested in this year's Survey included four knock-sensor-equipped models. The specifications of the engine-chassis combinations of the select models are in Table 1.

Maximum octane number requirements for each select model at various satisfaction levels are listed in Tables 13 through 20. The maximum (high-borderline) and minimum (low-borderline) octane number requirements for the four knock sensor-equipped models are given in Tables 14, 15, 16, and 18.

E. Tank Fuel

Tank fuel was tested for incidence of knock on all vehicles. Owners' questionnaires, however, were obtained only when the vehicle tested had a regular driver and the ignition timing did not have to be reset.

1. Owner/Rater Comparisons of Tank Fuel Knock

For 155 vehicles, both owner and rater data were reported, and no adjustments of spark timing were made. The trained raters reported that 39 percent of the vehicles knocked, while the owners reported that 16 percent knocked, an owner/rater knock ratio of 0.39. The 39 percent of vehicles found to be knocking by trained raters is about the same as in the 1987 Survey. These owner/rater comparisons of tank fuel knock for 1988, along with previous Survey data back to 1981, are presented in Table 21.

Tank fuel RON and MON data were reported for a total of 114 vehicles with both owner/rater data and no adjustments of spark timing. Eighty-nine vehicles were reported to have tank fuel octane numbers less than 91.0 (R+M)/2. Trained observers reported knock on 47 percent of these, compared with 25 percent for owners. Of the other 25 vehicles having tank fuels greater than or equal to 91.0 (R+M)/2, 24 percent knocked according to trained raters, and 4 percent according to owners.

2. Objectionable Versus Non-Objectionable Knock

Of the owners reporting tank-fuel knock with vehicles which had no change in spark timing, 4 percent found the knock to be objectionable, in comparison with 3 percent in the 1987 Survey. Comparisons of objectionable knock for 1981 through 1988 Surveys are also given in Table 21.

3. Tank Fuel Knock Reported by Trained Raters

Tank fuel knock observations were reported for 293 of the 391 vehicles tested. The percentages of all 1988 vehicles knocking on tank fuel are shown in Table 22. Knock was observed on 31 percent of the 1988 vehicles tested, compared with 35 percent in the 1987 Survey.

The percentages of select models knocking on tank fuel, also shown in Table 22 varied from a low of 0 percent to a high of 77 percent.

F. Engine Speed for Maximum Octane Number Requirements

Engine speeds at which maximum octane number requirements occurred for each select model are shown in Table 23 for PR, FBRU, and FBRSU fuels. Weighted data for all 1988 vehicles are shown in Table 24.

G. Gear Position for Maximum Octane Number Requirements

The throttle/gear position for maximum octane number requirements on FBRU fuels is shown in Table 25. Of the 391 vehicles tested, 319 (82 percent) were equipped with automatic transmissions and 72 (18 percent) were equipped with manual transmissions.

Maximum requirements at maximum-throttle occurred in 69 percent of the automatic transmission vehicles (10 percent in fourth gear, 42 percent in third gear, and 17 percent in second gear). Maximum requirements at part-throttle occurred in 31 percent of the automatic transmission vehicles (10 percent in fourth gear, 18 percent in third gear, and 3 percent in second gear).

For manual transmission vehicles, 76 percent had maximum requirements at maximum-throttle (61 percent in fourth gear, 13 percent in third gear, and 2 percent in second gear). Maximum requirements at part-throttle occurred in 24 percent of manual transmission vehicles (21 percent in fourth gear, and 3 percent in third gear). Fifth gear for five-speed manual transmissions was not examined per program instructions.

TABLES

AND

FIGURES

TABLE 1

1988 SELECT MODEL SPECIFICATIONS

Model	Knock Sensor	Disp. (L)	Engine Type	Fuel System Type*	Comp. Ratio	Brake HP	Trans-mission
Chrysler Corporation:							
PKD T22A3/KPD T22A3		2.2	L4	TBI	9.5	93	A3
Ford Motor Company:							
MC5 P16A3		1.6	L4	PFI	9.3	82	A3
ODU P30A4/MDU P30A4	KS	3.0	V6	PFI	9.3	140	A4
OPF P50A4/OSF P50A4/ MPF P50A4/SPF P50A4		5.0	V8	PFI	8.9	150	A4
General Motors Corporation:							
NAR T25A3/HAR T25A3/ IAR T25A3/LAR T25A3		2.5	L4	TBI	8.3	98	A3
NAW P28A3/NLW P28A3/HAW P28A3 IAW P28A3/LAW P28A3	KS	2.8	V6	PFI	8.9	125	A3
NAW P28A4/HWW P28A4/IWW P28A4 LAW P28A4/LWW P28A4	KS	2.8	V6	PFI	8.9	125	A4
HHC P38A4/ICC P38A4/ IHC P38A4/LHC P38A4	KS	3.8	V6	PFI	8.5	165	A4

* TBI = Throttle Body Fuel Injection; PFI = Port Fuel Injection. Individual manufacturers may use different abbreviations.

TABLE 2

DISTRIBUTION OF ODOMETER MILEAGE FOR TESTED VEHICLES

Mileage	No. of Vehicles Within Mileage Increments	
	1987 Vehicles	1988 Vehicles
0 - 1,999	0	0
2,000 - 3,999	0	0
4,000 - 5,999	3	4
6,000 - 7,999	59	80
8,000 - 9,999	59	79
10,000 - 11,999	66	73
12,000 - 13,999	47	35
14,000 - 15,999	47	30
16,000 - 17,999	28	29
18,000 - 19,999	25	24
20,000 - 24,999	32	27
25,000 - 29,999	12	4
30,000 +	11	6
No. of Vehicles	389	391
Average Mileage	13,720	12,407

TABLE 3

1988 BASIC TIMING ADJUSTMENTS

Degrees From Manufacturer's Setting	No. of Vehicles	
	+	-
1	0	2
2	6	6
3	1	1
4	5	4
5	1	2
6	1	1
7	0	1
8	0	1
9	0	0
10	0	0
11+	0	1
	14	19

TOTAL 33

TABLE 4

MAXIMUM OCTANE NUMBER REQUIREMENTS WITH 95% CONFIDENCE LIMITS

	Fuel	No. Vehicles	(R+M)/2 50% Sat.	(R+M)/2 90% Sat.	Research Octane No. 50% Sat.	Research Octane No. 90% Sat.	Motor Octane No. 50% Sat.	Motor Octane No. 90% Sat.
Total Vehicles	PR	390	87.4±0.4	92.9±0.6	87.4±0.4	92.9±0.6	87.4±0.4	92.9±0.6
	FBRU	391	84.7±0.4	89.3±0.5	88.6±0.5	94.3±0.6	80.8±0.3	84.4±0.4
	FBRSU	391	84.7±0.4	89.8±0.6	89.9±0.5	95.9±0.7	79.4±0.3	83.7±0.5
Total Cars	PR	304	87.1±0.5	92.5±0.7	87.1±0.5	92.5±0.7	87.1±0.5	92.5±0.7
	FBRU	305	84.7±0.4	89.2±0.6	88.6±0.5	94.2±0.7	80.8±0.3	84.3±0.4
	FBRSU	305	84.5±0.5	89.8±0.7	89.7±0.6	95.9±0.8	79.3±0.4	83.7±0.6
Total Trucks and Vans	PR	86	88.0±1.0	93.7±1.3	88.0±1.0	93.7±1.3	88.0±1.0	93.7±1.3
	FBRU	86	84.8±0.8	89.6±1.1	88.7±1.0	94.6±1.3	80.9±0.6	84.6±0.8
	FBRSU	86	85.0±0.7	89.8±0.9	90.3±0.8	95.9±1.1	79.7±0.5	83.7±0.7
Total Knock-Sensor Vehicles	PR	155	87.9±0.8	93.4±1.0	87.9±0.8	93.4±1.0	87.9±0.8	93.4±1.0
	FBRU	155	85.0±0.7	90.2±0.9	89.0±0.8	95.3±1.1	81.1±0.5	85.1±0.7
	FBRSU	155	85.2±0.7	90.3±0.9	90.6±0.8	96.5±1.0	79.9±0.5	84.1±0.7

TABLE 5

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1988 TOTAL VEHICLES

[For Knock-Sensor Vehicles, Maximum (High-Borderline) Octane Number Requirements Are Used]

Percent Satisfied	PR Fuels		FBRU Fuels						FBRSU Fuels					
			(R+M)/2		RON		MON		(R+M)/2		RON		MON	
	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987
10	81.5	-1.4	79.9	-1.5	82.9	-1.8	76.9	-1.3	79.8	-1.0	84.1	-1.2	75.6	-0.7
20	83.9	-0.8	81.8	-0.8	85.1	-1.0	78.5	-0.6	81.5	-0.5	86.2	-0.6	76.8	-0.4
30	85.3	-0.6	83.0	-0.6	86.6	-0.7	79.4	-0.5	82.6	-0.6	87.5	-0.6	77.7	-0.5
40	86.4	-0.4	83.9	-0.7	87.7	-0.8	80.2	-0.5	83.7	-0.5	88.7	-0.7	78.6	-0.5
50	87.4	-0.5	84.7	-1.0	88.6	-1.2	80.8	-0.8	84.7	-0.8	89.9	-1.0	79.4	-0.7
60	88.4	-0.8	85.7	-1.0	89.8	-1.3	81.6	-0.8	85.6	-0.9	91.0	-1.1	80.2	-0.8
70	89.5	-0.9	86.8	-1.1	91.2	-1.3	82.4	-0.9	86.7	-1.0	92.3	-1.2	81.1	-0.8
80	91.1	-0.6	88.0	-0.8	92.6	-1.1	83.3	-0.7	88.0	-1.1	93.8	-1.3	82.1	-1.0
90	92.9	-0.6	89.3	-1.2	94.3	-1.3	84.4	-0.9	89.8	-1.3	95.9	-1.5	83.7	-1.1
95	93.9	-0.8	90.6	-2.0	95.7	-2.4	85.4	-1.6	91.0	-2.4	97.3	-2.6	84.8	-2.2
98	95.6	-1.3	92.0	-2.9	97.5	-3.0	86.6	-2.7	92.5	-	98.8	-	86.1	-
99	96.6	-	92.9	-	98.5	-	87.3	-	94.6	-	101.1	-	88.1	-

TABLE 6

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1988 TOTAL VEHICLES

[For Knock-Sensor Vehicles, Minimum (Low-Borderline) Octane Number Requirements Are Used]

Percent Satisfied	PR Fuels		FBRU Fuels						FBRSU Fuels					
			(R+M)/2		RON		MON		(R+M)/2		RON		MON	
	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987
10	80.9	-1.7	79.5	-1.6	82.4	-1.9	76.5	-1.4	79.3	-1.1	83.5	-1.3	75.1	-0.9
20	83.4	-1.2	81.4	-1.0	84.6	-1.3	78.1	-0.8	81.0	-0.8	85.6	-0.9	76.4	-0.7
30	84.6	-1.2	82.4	-1.0	85.9	-1.2	79.0	-0.7	82.0	-0.9	86.8	-1.1	77.3	-0.7
40	85.6	-1.2	83.3	-1.1	86.9	-1.3	79.7	-0.8	82.9	-1.0	87.9	-1.1	78.0	-0.8
50	86.7	-1.1	84.0	-1.4	87.8	-1.6	80.3	-1.0	83.8	-1.3	88.9	-1.5	78.7	-1.1
60	87.6	-1.4	85.0	-1.3	88.9	-1.7	81.0	-1.1	84.8	-1.4	90.1	-1.6	79.6	-1.1
70	88.7	-1.4	86.0	-1.6	90.2	-1.9	81.8	-1.2	85.9	-1.4	91.4	-1.7	80.4	-1.2
80	90.0	-1.3	87.3	-1.3	91.8	-1.6	82.8	-1.0	87.2	-1.4	92.9	-1.7	81.4	-1.3
90	92.2	-0.9	88.6	-1.2	93.4	-1.4	83.9	-0.9	89.2	-1.4	95.2	-1.6	83.2	-1.1
95	93.5	-0.6	89.9	-1.7	94.9	-2.1	84.8	-1.4	90.3	-2.2	96.5	-2.3	84.2	-1.9
98	94.9	-0.8	91.2	-3.3	96.5	-3.6	85.9	-3.0	91.8	-	98.1	-	85.5	-
99	96.4	-1.4	92.1	-2.9	97.6	-3.0	86.6	-2.8	93.5	-	100.0	-	87.1	-

TABLE 7

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1988 TOTAL CARS

[For Knock-Sensor Vehicles, Maximum (High-Borderline) Octane Number Requirements Are Used]

Percent Satisfied	PR Fuels		FBRU Fuels						FBRSU Fuels					
			(R+M)/2		RON		MON		(R+M)/2		RON		MON	
	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987
10	80.9	-2.0	79.4	-2.1	82.3	-2.5	76.5	-1.7	79.4	-1.3	83.7	-1.5	75.2	-1.0
20	83.4	-1.1	81.4	-1.0	84.7	-1.2	78.2	-0.8	81.1	-0.8	85.7	-0.9	76.5	-0.6
30	84.8	-0.7	82.8	-0.4	86.4	-0.5	79.3	-0.3	82.4	-0.6	87.2	-0.7	77.5	-0.6
40	85.9	-0.5	83.8	-0.5	87.5	-0.6	80.1	-0.4	83.5	-0.5	88.6	-0.5	78.5	-0.4
50	87.1	-0.3	84.7	-0.7	88.6	-0.8	80.8	-0.5	84.5	-0.7	89.7	-0.8	79.3	-0.6
60	88.1	-0.5	85.6	-0.9	89.7	-1.1	81.5	-0.7	85.4	-0.9	90.8	-1.1	80.0	-0.8
70	89.3	-0.8	86.8	-0.9	91.2	-1.1	82.4	-0.7	86.8	-1.0	92.4	-1.2	81.2	-0.7
80	90.9	-0.6	88.0	-0.8	92.6	-1.0	83.4	-0.6	88.3	-0.9	94.2	-1.0	82.3	-0.9
90	92.5	-0.6	89.2	-1.2	94.2	-1.3	84.3	-0.9	89.8	-0.9	95.9	-1.1	83.7	-0.8
95	93.4	-1.2	90.2	-1.7	95.3	-2.0	85.1	-1.4	90.8	-1.9	97.0	-2.1	84.5	-1.8
98	94.6	-2.1	91.6	-2.0	97.0	-2.2	86.3	-1.7	92.4	-2.4	98.8	-2.5	86.0	-2.3
99	96.2	-	93.8	-1.1	99.4	-1.1	88.2	-1.1	94.8	-	101.3	-	88.3	-

TABLE 8

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1988 TOTAL CARS

[For Knock-Sensor Vehicles, Minimum (Low-Borderline) Octane Number Requirements Are Used]

Percent Satisfied	PR Fuels		FBRU Fuels						FBRSU Fuels					
			(R+M)/2		RON		MON		(R+M)/2		RON		MON	
	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987
10	80.3	-2.3	78.9	-2.2	81.6	-2.7	76.1	-1.8	78.7	-1.7	82.9	-1.9	74.6	-1.4
20	82.9	-1.5	81.0	-1.3	84.2	-1.6	77.9	-1.0	80.7	-1.0	85.1	-1.4	76.2	-0.8
30	84.4	-1.1	82.5	-0.7	86.0	-0.8	79.0	-0.5	82.0	-0.8	86.8	-1.0	77.3	-0.6
40	85.6	-0.8	83.4	-0.7	87.1	-0.8	79.8	-0.5	83.1	-0.7	88.1	-0.8	78.1	-0.6
50	86.7	-0.6	84.2	-0.9	88.0	-1.1	80.4	-0.8	84.1	-0.9	89.2	-1.1	79.0	-0.7
60	87.6	-0.9	85.2	-1.0	89.2	-1.2	81.2	-0.8	85.0	-1.1	90.3	-1.3	79.7	-0.9
70	88.7	-1.1	86.3	-1.2	90.5	-1.5	82.0	-0.9	86.2	-1.1	91.8	-1.3	80.7	-0.9
80	90.1	-1.0	87.5	-1.0	92.0	-1.3	82.9	-0.9	87.5	-1.2	93.3	-1.4	81.7	-1.0
90	92.1	-0.7	88.7	-1.2	93.4	-1.6	83.9	-1.0	89.4	-1.0	95.4	-1.2	83.3	-0.9
95	93.0	-0.8	90.0	-1.3	95.0	-1.6	84.9	-1.1	90.4	-1.7	96.6	-1.8	84.2	-1.5
98	94.4	-1.5	91.3	-1.9	96.6	-2.2	86.0	-1.6	92.3	-2.1	98.6	-2.3	85.9	-2.0
99	95.7	-3.1	93.0	-1.4	98.5	-1.5	87.4	-1.4	94.7	-	101.2	-	88.1	-

TABLE 9

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1988 TOTAL TRUCKS AND VANS

[For Knock-Sensor Vehicles, Maximum (High-Borderline) Octane Number Requirements Are Used]

Percent Satisfied	PR Fuels		FBRU Fuels						FBRSU Fuels					
			(R+M)/2		RON		MON		(R+M)/2		RON		MON	
	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987
10	82.7	-0.3	80.9	-0.2	84.1	-0.2	77.8	-0.1	80.9	0.1	85.5	0.2	76.4	0.1
20	85.0	-0.6	82.2	-1.2	85.6	-1.5	78.8	-1.0	82.1	-0.4	86.8	-0.6	77.3	-0.3
30	86.0	-1.0	83.5	-0.8	87.2	-0.9	79.8	-0.7	83.0	-0.7	88.0	-0.7	78.1	-0.5
40	87.2	-0.8	84.1	-1.2	87.9	-1.5	80.3	-1.0	83.9	-1.0	89.0	-1.2	78.8	-0.9
50	88.0	-1.2	84.8	-1.5	88.7	-1.8	80.9	-1.1	85.0	-1.0	90.3	-1.2	79.7	-0.9
60	88.9	-1.3	85.9	-1.3	90.1	-1.6	81.7	-1.0	85.8	-1.0	91.2	-1.2	80.4	-0.8
70	90.1	-1.1	86.8	-1.5	91.2	-1.8	82.4	-1.2	86.6	-1.0	92.1	-1.3	81.0	-0.8
80	91.6	-0.6	87.9	-1.0	92.5	-1.3	83.3	-0.8	87.4	-1.4	93.2	-1.6	81.6	-1.3
90	93.7	-0.3	89.6	-2.0	94.6	-2.4	84.6	-1.7	89.8	-2.4	95.9	-2.6	83.7	-2.1
95	95.1	-0.5	91.4	-3.3	96.7	-3.6	86.1	-3.0	91.4	-	97.7	-	85.1	-
98	96.3	-1.5	92.2	-3.2	97.7	-3.3	86.7	-3.1	93.1	-	99.5	-	86.7	-
99	96.8	-	-	-	-	-	-	-	94.3	-	100.8	-	87.8	-

TABLE 10

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1988 TOTAL TRUCKS AND VANS

[For Knock-Sensor Vehicles, Minimum (Low-Borderline) Octane Number Requirements Are Used]

Percent Satisfied	PR Fuels		FBRU Fuels						FBRSU Fuels					
			(R+M)/2		RON		MON		(R+M)/2		RON		MON	
	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987
10	82.2	-0.6	80.8	-0.1	83.9	-0.2	77.6	-0.1	80.6	0.2	85.1	0.3	76.1	0.1
20	84.1	-1.2	81.7	-1.4	85.1	-1.6	78.4	-1.1	81.4	-0.6	86.0	-0.8	76.7	-0.6
30	84.9	-2.0	82.4	-1.7	85.8	-2.0	78.9	-1.4	82.0	-1.2	86.8	-1.3	77.3	-0.9
40	85.7	-2.2	83.1	-1.9	86.7	-2.2	79.5	-1.5	82.7	-1.5	87.6	-1.8	77.8	-1.3
50	86.7	-2.3	83.8	-2.0	87.5	-2.4	80.0	-1.6	83.4	-2.1	88.4	-2.4	78.4	-1.7
60	87.7	-2.1	84.5	-2.1	88.3	-2.7	80.6	-1.7	84.4	-2.2	89.5	-2.7	79.2	-1.8
70	88.7	-1.9	85.4	-2.7	89.5	-3.2	81.4	-2.0	85.4	-1.9	90.7	-2.3	80.0	-1.5
80	89.9	-1.7	86.9	-1.8	91.3	-2.2	82.5	-1.4	86.6	-1.8	92.2	-2.2	81.0	-1.5
90	93.1	-0.6	88.6	-1.4	93.3	-1.8	83.8	-1.1	88.0	-3.4	93.9	-3.8	82.1	-3.0
95	94.2	-0.2	89.8	-1.7	94.8	-1.9	84.7	-1.5	90.0	-	96.1	-	83.9	-
98	95.8	0.8	91.0	-1.9	96.3	-2.0	85.8	-1.7	91.3	-	97.6	-	85.0	-
99	96.7	0.7	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 11

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1988 TOTAL KNOCK-SENSOR VEHICLES

[For Knock Sensor Vehicles, Maximum (Low-Borderline) Octane Number Requirements Are Used]

	PR Fuels		FBRU Fuels						FBRSU Fuels					
			(R+M)/2		RON		MON		(R+M)/2		RON		MON	
Percent Satisfied	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987
10	80.1	-2.0	78.9	-1.2	81.6	-1.5	76.1	-1.0	79.3	-0.6	83.5	-0.6	75.1	-0.5
20	83.1	-1.1	81.3	-1.0	84.5	-1.3	78.0	-0.9	81.2	-0.2	85.8	-0.3	76.6	-0.2
30	84.7	-1.1	82.8	-1.1	86.3	-1.3	79.2	-0.9	82.5	-0.6	87.3	-0.7	77.6	-0.5
40	86.4	-1.3	84.1	-1.2	87.9	-1.4	80.3	-1.0	84.0	-0.7	89.1	-0.9	78.9	-0.6
50	87.9	-1.2	85.0	-1.6	89.0	-1.9	81.1	-1.1	85.2	-0.9	90.6	-1.0	79.9	-0.7
60	89.1	-1.2	86.3	-1.4	90.5	-1.8	82.0	-1.1	86.2	-0.8	91.7	-1.0	80.7	-0.6
70	90.7	-0.6	87.7	-0.9	92.3	-1.1	83.1	-0.7	87.3	-1.0	93.1	-1.1	81.6	-0.8
80	92.2	-0.2	88.8	-0.9	93.7	-1.0	84.0	-0.7	88.8	-1.0	94.8	-1.0	82.8	-0.9
90	93.4	-1.2	90.2	-1.7	95.3	-2.0	85.1	-1.4	90.3	-2.3	96.5	-2.5	84.1	-2.1
95	94.1	-2.1	91.4	-1.9	96.7	-2.2	86.1	-1.6	91.4	-3.0	97.7	-3.2	85.1	-2.8
98	95.4	-	92.3	-	97.8	-	86.8	-	93.1	-	99.5	-	86.6	-
99	-	-	92.7	-	98.3	-	87.1	-	-	-	-	-	-	-

TABLE 12

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1988 TOTAL KNOCK-SENSOR VEHICLES

[For Knock Sensor Vehicles, Minimum (Low-Borderline) Octane Number Requirements Are Used]

Percent Satisfied	PR Fuels		FBRU Fuels						FBRSU Fuels					
			(R+M)/2		RON		MON		(R+M)/2		RON		MON	
	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987	1988	Δ from 1987
10	77.0	-4.2	-	-	-	-	-	-	77.8	-0.4	81.7	-0.5	73.8	-0.4
20	81.5	-1.9	80.1	-1.4	83.2	-1.5	77.1	-1.1	80.2	-0.6	84.5	-0.8	75.8	-0.5
30	83.3	-2.1	81.6	-1.5	84.9	-1.8	78.3	-1.2	81.1	-1.0	85.7	-1.2	76.5	-0.8
40	84.3	-3.3	82.4	-2.1	85.8	-2.5	78.9	-1.7	81.9	-1.6	86.6	-1.9	77.1	-1.4
50	85.1	-3.7	83.0	-2.5	86.6	-3.0	79.4	-2.0	82.7	-2.3	87.6	-2.7	77.8	-1.9
60	86.3	-3.3	83.8	-2.8	87.5	-3.4	80.0	-2.2	83.6	-2.7	88.6	-3.2	78.5	-2.3
70	87.6	-2.8	84.9	-3.2	88.9	-3.8	81.0	-2.4	85.0	-2.2	90.3	-2.6	79.7	-1.8
80	89.3	-2.1	86.6	-2.2	90.9	-2.7	82.2	-1.7	86.5	-1.8	92.1	-2.1	80.9	-1.5
90	92.2	-1.0	88.6	-1.3	93.4	-1.5	83.8	-1.1	88.5	-2.5	94.4	-2.9	82.5	-2.3
95	93.2	-1.5	90.1	-1.6	95.1	-2.0	85.0	-1.3	89.6	-3.1	95.6	-3.6	83.5	-2.8
98	94.0	-3.3	90.9	-2.5	96.1	-2.9	85.6	-2.2	90.9	-3.7	97.2	-3.9	84.6	-3.5
99	-	-	91.5	-	96.8	-	86.1	-	91.9	-3.3	98.3	-3.5	85.6	-3.1

TABLE 13

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1988 SELECT MODELS

SELECT MODEL: NAR T25A3/HAR T25A3/IAR T25A3/LAR T25A3

Percent Satisfied	PR ON	FBRU			FBRSU		
		RON	MON	(R+M)/2	RON	MON	(R+M)/2
5	80.6	85.1	77.9	81.5	88.1	77.8	82.9
10	82.1	86.8	79.2	83.0	89.7	79.1	84.4
20	83.9	89.0	80.8	84.9	91.7	80.6	86.1
30	85.2	90.5	81.9	86.2	93.1	81.7	87.4
40	86.3	91.8	82.9	87.3	94.3	82.7	88.5
50	87.3	93.0	83.8	88.4	95.4	83.5	89.5
60	88.3	94.2	84.7	89.5	96.5	84.4	90.5
70	89.4	95.5	85.7	90.6	97.7	85.4	91.6
80	90.7	97.0	86.8	91.9	99.2	86.5	92.8
90	92.5	99.2	88.4	93.8	101.1	88.0	94.6
95	94.0	100.9	89.7	95.3	102.7	89.3	96.0
N	18	18	18	18	18	18	18
Mean	87.3	93.0	83.8	88.4	95.4	83.5	89.5
Std. Dev. of the Distribution	4.1	4.8	3.6	4.2	4.4	3.5	4.0

TABLE 14

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1988 SELECT MODELS

Knock-Sensor Select Model - High Borderline

SELECT MODEL: NAW P28A3/NLW P28A3/HAW P28A3/IAW P28A3/LAW P28A3

Percent Satisfied	PR ON	FBRU			FBRSU		
		RON	MON	(R+M)/2	RON	MON	(R+M)/2
5	77.7	81.0	75.7	78.3	82.7	74.4	78.5
10	79.6	82.8	76.9	79.9	84.6	75.7	80.1
20	81.9	85.0	78.4	81.7	86.8	77.3	82.1
30	83.6	86.7	79.5	83.1	88.4	78.4	83.4
40	85.0	88.0	80.4	84.2	89.8	79.4	84.6
50	86.3	89.3	81.2	85.3	91.1	80.3	85.7
60	87.7	90.6	82.1	86.3	92.4	81.3	86.8
70	89.1	92.0	83.0	87.5	93.8	82.3	88.0
80	90.8	93.6	84.1	88.8	95.4	83.4	89.4
90	93.1	95.8	85.5	90.7	97.7	85.0	91.3
95	95.0	97.7	86.8	92.2	99.5	86.3	92.9
N	17	17	17	17	17	17	17
Mean	86.3	89.3	81.2	85.3	91.1	80.3	85.7
Std. Dev. of the Distribution	5.3	5.1	3.4	4.2	5.1	3.6	4.4

TABLE 14 (Continued)

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1988 SELECT MODELS

Knock Sensor Select Model - Low Borderline

SELECT MODEL: NAW P28A3/NLW P28A3/HAW P28A3/IAW P28A3/LAW P28A3

Percent Satisfied	PR ON	FBRU			FBRSU		
		RON	MON	(R+M)/2	RON	MON	(R+M)/2
5	77.3	78.9	74.3	76.6	80.5	72.8	76.6
10	78.8	80.6	75.4	78.0	82.2	74.1	78.2
20	80.6	82.6	76.8	79.7	84.4	75.6	80.0
30	81.9	84.1	77.7	80.9	85.9	76.7	81.3
40	83.0	85.4	78.6	82.0	87.2	77.6	82.4
50	84.0	86.5	79.4	82.9	88.5	78.5	83.5
60	85.0	87.7	80.1	83.9	89.7	79.3	84.5
70	86.1	88.9	81.0	85.0	91.0	80.3	85.6
80	87.4	90.4	81.9	86.2	92.6	81.4	87.0
90	89.2	92.4	83.3	87.9	94.7	82.9	88.8
95	90.7	94.1	84.4	89.3	96.5	84.1	90.3
N	17	17	17	17	17	17	17
Mean	84.0	86.5	79.4	82.9	88.5	78.5	83.5
Std. Dev. of the Distribution	4.1	4.6	3.1	3.8	4.9	3.4	4.1

TABLE 15

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1988 SELECT MODELS

Knock-Sensor Select Model - High Borderline

SELECT MODEL: NAW P28A4/HWW P28A4/IWW P28A4/LAW P28A4/LWW P28A4

Percent Satisfied	PR ON	FBRU			FBRSU		
		RON	MON	(R+M)/2	RON	MON	(R+M)/2
5	76.3	78.1	73.8	76.0	79.4	72.1	75.7
10	78.0	80.1	75.1	77.6	81.4	73.5	77.5
20	80.0	82.4	76.6	79.5	83.8	75.2	79.5
30	81.4	84.1	77.8	80.9	85.6	76.5	81.0
40	82.7	85.5	78.7	82.1	87.1	77.5	82.3
50	83.8	86.9	79.6	83.2	88.5	78.5	83.5
60	85.0	88.2	80.5	84.4	89.9	79.5	84.7
70	86.2	89.7	81.4	85.6	91.4	80.5	86.0
80	87.7	91.4	82.6	87.0	93.1	81.8	87.4
90	89.7	93.7	84.1	88.9	95.6	83.5	89.5
95	91.4	95.6	85.4	90.5	97.6	84.9	91.2
N	19	19	19	19	19	19	19
Mean	83.8	86.9	79.6	83.2	88.5	78.5	83.5
Std. Dev. of the Distribution	4.6	5.3	3.5	4.4	5.5	3.9	4.7

TABLE 15 (Continued)

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1988 SELECT MODELS

Knock-Sensor Select Model - Low Borderline

SELECT MODEL: NAW P28A4/HWW P28A4/IWW P28A4/LAW P28A4/LWW P28A4

Percent Satisfied	PR ON	FBRU			FBRSU		
		RON	MON	(R+M)/2	RON	MON	(R+M)/2
5	75.9	79.3	74.5	76.9	80.2	72.9	76.6
10	77.3	80.5	75.3	77.9	81.7	73.8	77.7
20	79.0	82.1	76.4	79.2	83.4	75.0	79.2
30	80.2	83.2	77.1	80.2	84.6	75.8	80.2
40	81.2	84.1	77.8	81.0	85.7	76.5	81.1
50	82.2	85.0	78.4	81.7	86.6	77.2	81.9
60	33.2	85.9	79.0	82.4	87.6	77.9	82.7
70	84.2	86.9	79.6	83.2	88.7	78.6	83.6
80	85.4	88.0	80.4	84.2	89.9	79.4	84.7
90	87.1	89.5	81.4	85.5	91.6	80.6	86.1
95	88.5	90.8	82.3	86.5	93.0	81.5	87.3
N	18	18	18	18	18	18	18
Mean	82.2	85.0	78.4	81.7	86.6	77.2	81.9
Std. Dev. of the Distribution	3.8	3.5	2.4	2.9	3.9	2.6	3.3

TABLE 16

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1988 SELECT MODELS

Knock-Sensor Select Model - High Borderline

SELECT MODEL: HHC P38A4/ICC P38A4/IHC P38A4/LHC P38A4

Percent Satisfied	PR ON	FBRU			FBRSU		
		RON	MON	(R+M)/2	RON	MON	(R+M)/2
5	74.5	75.8	72.2	74.0	76.6	70.3	73.4
10	75.8	77.3	73.2	75.3	78.3	71.4	74.8
20	77.3	79.1	74.4	76.8	80.3	72.8	76.5
30	78.3	80.4	75.2	77.8	81.7	73.8	77.8
40	79.3	81.5	76.0	78.8	83.0	74.7	78.8
50	80.1	82.6	76.7	79.6	84.1	75.5	79.8
60	81.0	83.6	77.4	80.5	85.3	76.3	80.8
70	81.9	84.7	78.1	81.4	86.5	77.2	81.8
80	83.0	86.0	79.0	82.5	88.0	78.2	83.1
90	84.5	87.8	80.2	84.0	90.0	79.6	84.8
95	85.7	89.3	81.2	85.2	91.6	80.7	86.2
N	13	13	13	13	13	13	13
Mean	80.1	82.6	76.7	79.6	84.1	75.5	79.8
Std. Dev. of the Distribution	3.4	4.1	2.7	3.4	4.6	3.2	3.9

TABLE 16 (Continued)

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1988 SELECT MODELS

Knock Sensor Select Model - Low Borderline

SELECT MODEL: HHC P38A4/ICC P38A4/IHC P38A4/LHC P38A4

Percent Satisfied	PR ON	FBRU			FBRSU		
		RON	MON	(R+M)/2	RON	MON	(R+M)/2
5	74.0	76.1	72.4	74.2	75.9	69.8	72.9
10	75.1	77.2	73.1	75.2	77.3	70.8	74.1
20	76.5	78.6	74.1	76.4	79.1	72.0	75.5
30	77.4	79.6	74.7	77.2	80.3	72.9	76.6
40	78.3	80.5	75.3	77.9	81.4	73.6	77.5
50	79.1	81.3	75.9	78.6	82.4	74.3	78.3
60	79.9	82.1	76.4	79.3	83.4	74.9	79.2
70	80.7	83.0	77.0	80.0	84.4	75.7	80.1
80	81.7	84.0	77.7	80.8	85.7	76.5	81.1
90	83.1	85.4	78.6	82.0	87.4	77.7	82.6
95	84.2	86.5	79.4	83.0	88.9	78.7	83.8
N	13	13	13	13	12	12	12
Mean	79.1	81.3	75.9	78.6	82.4	74.3	78.3
Std. Dev. of the Distribution	3.1	3.2	2.1	2.7	3.9	2.7	3.3

TABLE 17

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1988 SELECT MODELS

SELECT MODEL: MC5 P16A3

Percent Satisfied	PR ON	FBRU			FBRSU		
		RON	MON	(R+M)/2	RON	MON	(R+M)/2
5	79.3	80.1	75.1	77.6	81.6	73.7	77.6
10	80.7	81.4	76.0	78.7	82.8	74.6	78.7
20	82.3	83.1	77.1	80.1	84.4	75.7	80.0
30	83.5	84.2	77.8	81.0	85.5	76.4	81.0
40	84.5	85.2	78.5	81.9	86.5	77.1	81.8
50	85.4	86.1	79.1	82.6	87.4	77.7	82.5
60	86.3	87.1	79.7	83.4	88.3	78.3	83.3
70	87.3	88.1	80.4	84.2	89.2	78.9	84.1
80	88.5	89.2	81.2	85.2	90.3	79.7	85.0
90	90.2	90.8	82.3	86.5	91.9	80.8	86.3
95	91.5	92.2	83.1	87.6	93.2	81.6	87.4
N	11	11	11	11	11	11	11
Mean	85.4	86.1	79.1	82.6	87.4	77.7	82.5
Std. Dev. of the Distribution	3.7	3.7	2.4	3.1	3.5	2.4	3.0

TABLE 18

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1988 SELECT MODELS

Knock Sensor Select Model - High Borderline

SELECT MODEL: ODU P30A4/MDU P30A4

Percent Satisfied	PR ON	FBRU			FBRSU		
		RON	MON	(R+M)/2	RON	MON	(R+M)/2
5	86.2	87.4	79.9	83.7	88.2	78.2	83.2
10	87.2	88.6	80.7	84.7	89.5	79.1	84.3
20	88.5	90.1	81.7	85.9	91.1	80.2	85.7
30	89.4	91.2	82.4	86.8	92.2	81.1	86.7
40	90.1	92.1	83.0	87.6	93.2	81.8	87.5
50	90.8	93.0	83.6	88.3	94.1	82.4	88.3
60	91.5	93.8	84.1	89.0	95.0	83.1	89.1
70	92.3	94.7	84.7	89.7	96.0	83.8	89.9
80	93.2	95.8	85.5	90.6	97.1	84.6	90.9
90	94.4	97.3	86.4	91.9	98.7	85.8	92.2
95	95.4	98.5	87.2	92.9	100.0	86.7	93.3
N	18	18	18	18	18	18	18
Mean	90.8	93.0	83.6	88.3	94.1	82.4	88.3
Std. Dev. of the Distribution	2.8	3.4	2.2	2.8	3.6	2.6	3.1

TABLE 18 (Continued)

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1988 SELECT MODELS

Knock-Sensor Select Model - Low Borderline

SELECT MODEL: ODU P30A4/MDU P30A4

Percent Satisfied	PR ON	FBRU			FBRSU		
		RON	MON	(R+M)/2	RON	MON	(R+M)/2
5	82.9	84.3	77.9	81.1	85.2	76.1	80.6
10	84.2	85.8	78.9	82.3	86.8	77.2	82.0
20	85.9	87.6	80.1	83.8	88.7	78.6	83.6
30	87.2	88.9	80.9	84.9	90.1	79.6	84.8
40	88.2	90.0	81.7	85.8	91.3	80.4	85.8
50	89.2	91.1	82.3	86.7	92.4	81.2	86.8
60	90.1	92.1	83.0	87.6	93.5	82.0	87.7
70	91.2	93.2	83.7	88.5	94.7	82.8	88.7
80	92.4	94.5	84.6	89.6	96.0	83.8	89.9
90	94.1	96.3	85.8	91.1	98.0	85.2	91.6
95	95.5	97.8	86.8	92.3	99.5	86.3	92.9
N	15	16	16	16	16	16	16
Mean	89.2	91.1	82.3	86.7	92.4	81.2	86.8
Std. Dev. of the distribution	3.8	4.1	2.7	3.4	4.4	3.1	3.7

TABLE 19

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1988 SELECT MODELS

SELECT MODEL: OPF P50A4/OSF P50A4/MPF P50A4/SPF P50A4

Percent Satisfied	PR ON	FBRU			FBRSU		
		RON	MON	(R+M)/2	RON	MON	(R+M)/2
5	84.0	83.7	77.6	80.7	84.3	75.5	79.9
10	85.1	85.0	78.4	81.7	85.5	76.4	81.0
20	86.5	86.5	79.4	82.9	87.0	77.5	82.2
30	87.4	87.6	80.1	83.8	88.1	78.2	83.2
40	88.3	88.5	80.7	84.6	89.0	78.9	84.0
50	89.0	89.4	81.3	85.3	89.9	79.5	84.7
60	89.8	90.3	81.8	86.1	90.8	80.1	85.4
70	90.6	91.2	82.4	86.8	91.7	80.7	86.2
80	91.6	92.3	83.2	87.7	92.8	81.5	87.1
90	92.9	93.8	84.2	89.0	94.3	82.5	88.4
95	94.1	95.1	85.0	90.0	95.6	83.4	89.5
N	12	12	12	12	12	12	12
Mean	89.0	89.4	81.3	85.3	89.9	79.5	84.7
Std. Dev. of the Distribution	3.0	3.4	2.3	2.9	3.4	2.4	2.9

TABLE 20

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1988 SELECT MODELS

SELECT MODEL: PKD T22A3/PPD T22A3/KPD T22A3

Percent Satisfied	PR ON	FBRU			FBRSU		
		RON	MON	(R+M)/2	RON	MON	(R+M)/2
5	82.5	82.7	76.9	79.8	82.9	74.7	78.8
10	83.2	83.6	77.4	80.5	83.8	75.3	79.5
20	83.9	84.6	78.1	81.3	84.9	76.0	80.5
30	84.5	85.3	78.6	81.9	85.7	76.6	81.1
40	85.0	85.9	79.0	82.4	86.3	77.0	81.7
50	85.4	86.5	79.4	82.9	87.0	77.4	82.2
60	85.9	87.0	79.7	83.4	87.6	77.9	82.7
70	86.3	87.6	80.1	83.9	88.3	78.3	83.3
80	86.9	88.3	80.6	84.5	89.0	78.8	83.9
90	87.6	89.3	81.3	85.3	90.1	79.6	84.8
95	88.3	90.2	81.8	86.0	91.0	80.2	85.6
N	11	11	11	11	11	11	11
Mean	85.4	86.5	79.4	82.9	87.0	77.4	82.2
Std. Dev. of the Distribution	1.7	2.3	1.5	1.9	2.5	1.7	2.1

TABLE 21

OWNER/RATER COMPARISON OF TANK FUEL KNOCK

(1981-1988 CRC Octane Number Requirement Surveys)

Model Year:	1988	1987	1986	1985	1984	1983	1982	1981
Fuel:	Unleaded	Unleaded	Unleaded	Unleaded	Unleaded	Unleaded	Unleaded	Unleaded
Total Reports:	155	179	160	143	149	129	144	149
Percent Knocking								
Trained Rater	39.4	39.7	33.1	37.8	51.7	59.7	47.9	43.6
Owner	15.5	24.0	16.3	18.9	26.2	29.5	25.0	29.5
Owner/Rater Ratio	0.39	0.61	0.49	0.50	0.51	0.49	0.52	0.68
Percent Owners Objecting								
Based on:								
Total Reports	0.6	2.8	2.5	9.8	7.4	12.4	13.2	12.1
Owners Reporting Knock	4.2	11.6	15.4	51.9	28.2	42.1	52.8	40.9

TABLE 22

TANK-FUEL KNOCK REPORTED BY TRAINED OBSERVERS

I. Total Vehicles

Model Year	No. Survey	Vehicles Tested on Tank Fuel	
		No. Tested	% Knocking (Unweighted Average)
1988	391	293	31
1987	389	322	35
1986	377	330	31*
1985	374	327	37*
1984	407	358	49*
1983	383	314	45*
1982	434	342	42*
1981	417	326	43*

II. 1988 Select Models	No. in Survey	No. Tested	% Knocking
NAR T25A3/HAR T25A3/ IAR T25A3/LAR T25A3	18	13	54
NAW P28A3/NLW P28A3/ HAW P28A3/IAW P28A3/ LAW P28A3	17	13	39
NAW P28A4/HWW P28A4/ IWW P28A4/LAW P28A4/ LWW P28A4	19	13	8
HHC P38A4/ICC P38A4/ IHC P38A4/LHC P38A4	13	8	13
MC5 P16A3	11	8	0
ODU P30A4/MDU P30A4	18	13	77
OPF P50A4/OSF P50A4/ MPF P50A4/SPF P50A4	12	10	30
PKD T22A3/KPD T22A3	11	8	0

* weighted average

TABLE 23

ENGINE SPEEDS FOR MAXIMUM OCTANE NUMBER REQUIREMENTS - 1988 SELECT MODELS

Percent of Cars Having Maximum Requirements Within Specified Speed (rpm) Ranges

	Model:	NAR T25A3/HAR T25A3/IAR T25A3/ LAR T25A3			NAW P28A3/HAW P28A3/ IAW P28A3/LAW P28A3/ NLW P28A3 Knock Sensor, Maximum (High-Borderline)			NAW P28A3/HAW P28A3/ IAW P28A3/LAW P28A3/ NLW P28A3 Knock Sensor, Minimum (Low-Borderline)		
	Fuel:	PR	FBRU	FBRSU	PR	FBRU	FBRSU	PR	FBRU	FBRSU
SPEED RANGE										
1599 and Lower		6	6	12	7	6	0	7	6	6
1600 - 1999		11	6	6	0	6	0	0	6	0
2000 - 2399		17	35	28	33	25	43	33	19	38
2400 - 2799		38	18	24	40	44	38	47	50	43
2800 - 3199		28	29	24	20	19	19	13	19	13
3200 and Higher		0	6	6	0	0	0	0	0	0
No. of Cars		18	18	18	17	17	17	17	17	17

	Model:	HHC P38A4/ICC P38A4/ IHC P38A4/LHC P38A4 Knock Sensor, Maximum (High-Borderline)			HHC P38A4/ICC P38A4/ IHC P38A4/LHC P38A4 Knock Sensor, Minimum (Low-Borderline)			PKD T22A3/PPD T22A3 KPD T22A3		
	Fuel:	PR	FBRU	FBRSU	PR	FBRU	FBRSU	PR	FBRU	FBRSU
SPEED RANGE										
1599 and Lower		42	18	18	55	14	45	0	0	0
1600 - 1999		25	46	18	18	43	11	9	28	18
2000 - 2399		33	36	55	18	29	33	55	27	18
2400 - 2799		0	0	9	9	14	11	27	18	37
2800 - 3199		0	0	0	0	0	0	9	18	9
3200 and Higher		0	0	0	0	0	0	0	9	18
No. of Cars		13	13	13	13	13	12	11	11	11

TABLE 23
(Continued)

ENGINE SPEEDS FOR MAXIMUM OCTANE NUMBER REQUIREMENTS - 1988 SELECT MODELS

Percent of Cars Having Maximum Requirements Within Specified Speed (rpm) Ranges

	Model:	MC5 P16A3			OPF P50A4/OSF P50A4 MPF P50A4/SPF P50A4			ODU P30A4/MDU P30A4 Knock Sensor, Maximum (High-Borderline)		
SPEED RANGE	Fuel:	PR	FBRU	FBRSU	PR	FBRU	FBRSU	PR	FBRU	FBRSU
1599 and Lower		0	0	0	59	75	75	33	33	38
1600 - 1999		0	0	0	33	25	17	38	44	33
2000 - 2399		18	18	0	0	0	0	17	11	6
2400 - 2799		0	0	9	8	0	8	6	0	6
2800 - 3199		64	46	73	0	0	0	0	6	0
3200 and Higher		18	36	18	0	0	0	6	6	17
No. of Cars		11	11	11	12	12	12	18	18	18

	Model:	ODU P30A4/MDU P30A4 Knock Sensor, Minimum (Low-Borderline)			NAW P28A4/HWW P28A4/ IWW P28A4/LAW P28A4/ LWW P28A4 Knock-Sensor, Maximum (High-Borderline)			NAW P28A4.HWW P28A4/ IWW P28A4/LAW P28A4/ LWW P28A4 Knock-Senosr, Minimum (Low-Borderline)		
SPEED RANGE	Fuel:	PR	FBRU	FBRSU	PR	FBRU	FBRSU	PR	FBRU	FBRSU
1599 and Lower		33	38	25	6	6	6	6	0	0
1600 - 1999		40	50	37	44	46	44	37	55	46
2000 - 2399		20	6	19	17	12	11	19	13	12
2400 - 2799		7	0	6	11	18	17	13	19	12
2800 - 3199		0	6	0	22	18	22	25	13	24
3200 and Higher		0	0	13	0	0	0	0	0	6
No. of Cars		15	16	16	19	19	19	18	18	18

TABLE 24

ENGINE SPEEDS FOR MAXIMUM OCTANE NUMBER REQUIREMENTS

Weighted % of Vehicles Having Requirements
in Indicated (rpm) Ranges

All 1988 Vehicles

Maximum Requirements Engine Speed Range	PR Fuels	FBRU Fuels	FBRSU Fuels
1599 and Lower	18	18	16
1600 - 1999	19	16	14
2000 - 2399	27	22	20
2400 - 2799	17	20	20
2800 - 3199	14	13	17
3200 - 3599	4	8	8
3600 and Higher	2	3	5

TABLE 25

THROTTLE/GEAR POSITION FOR 1988 MAXIMUM FBRU OCTANE NUMBER REQUIREMENTS

Throttle Position	Transmission Type & Gear		No. of Vehicles*	% of Vehicles
	Automatic Transmission			
Maximum	4-Speed:	4th	31	10.1
		3rd	49	15.9
		2nd	25	8.1
	3-Speed:	3rd	80	26.0
		2nd	27	8.8
Part	4-Speed:	4th	32	10.4
		3rd	22	7.1
		2nd	2	.6
	3-Speed	3rd	33	10.7
		2nd	7	2.3
			308	100.0
	Manual Transmission			
Maximum	5-Speed:	4th	37	55.1
		3rd	6	9.0
		2nd	1	1.5
	4-Speed:	4th	4	6.0
		3rd	3	4.5
Part	5-Speed:	4th	11	16.4
		3rd	2	3.0
	4-Speed:	4th	3	4.5
			67	100.0

* Sixteen test vehicles not included, because octane number requirements were outside the range of test fuels.

Figure 1
DISTRIBUTION OF ODOMETER MILEAGE FOR 1988 MODEL VEHICLES TESTED

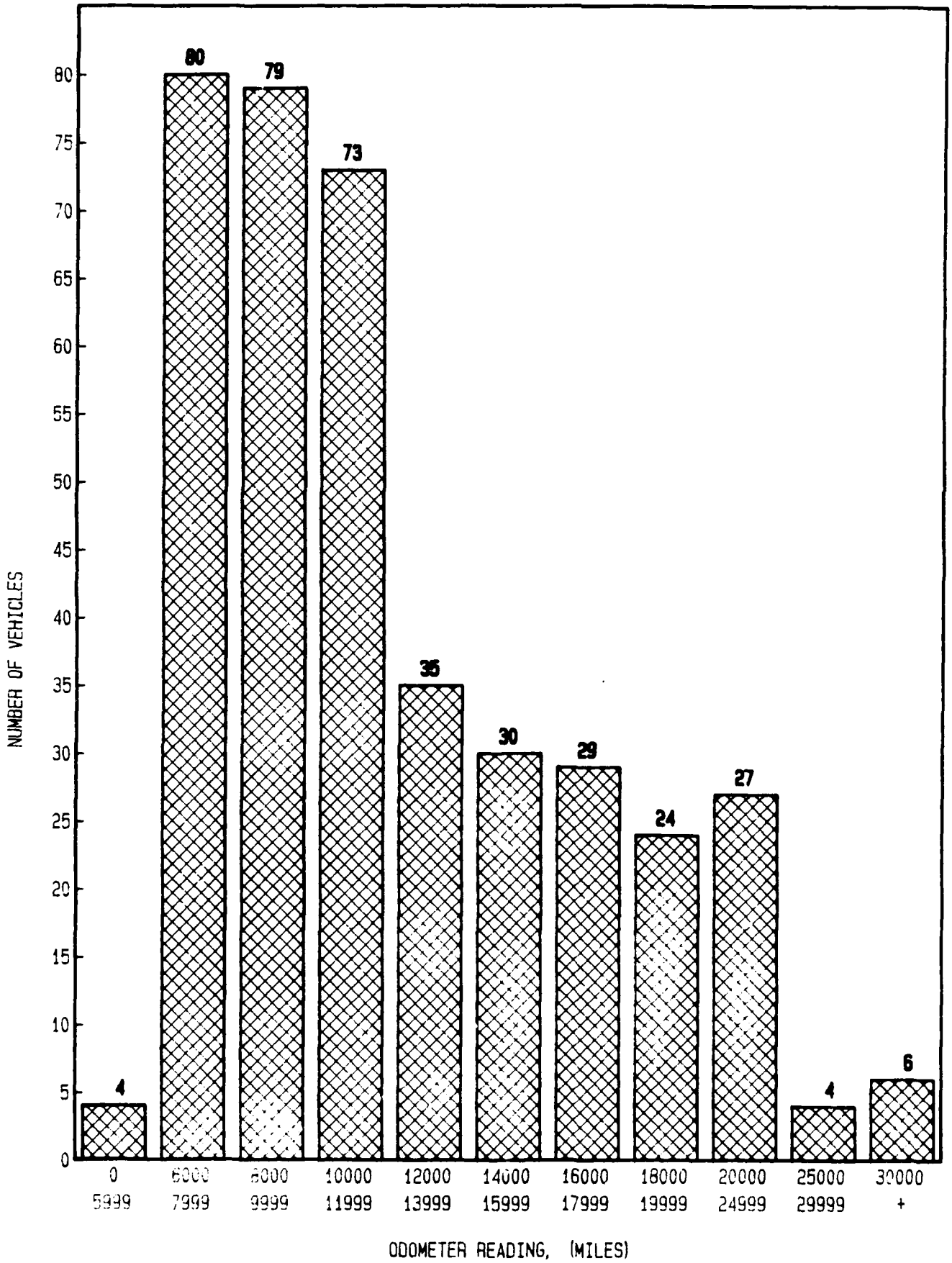


Figure 2
DISTRIBUTION OF MAXIMUM PR FUEL (R+M)/2 OCTANE NUMBER REQUIREMENTS
1988 TOTAL VEHICLES

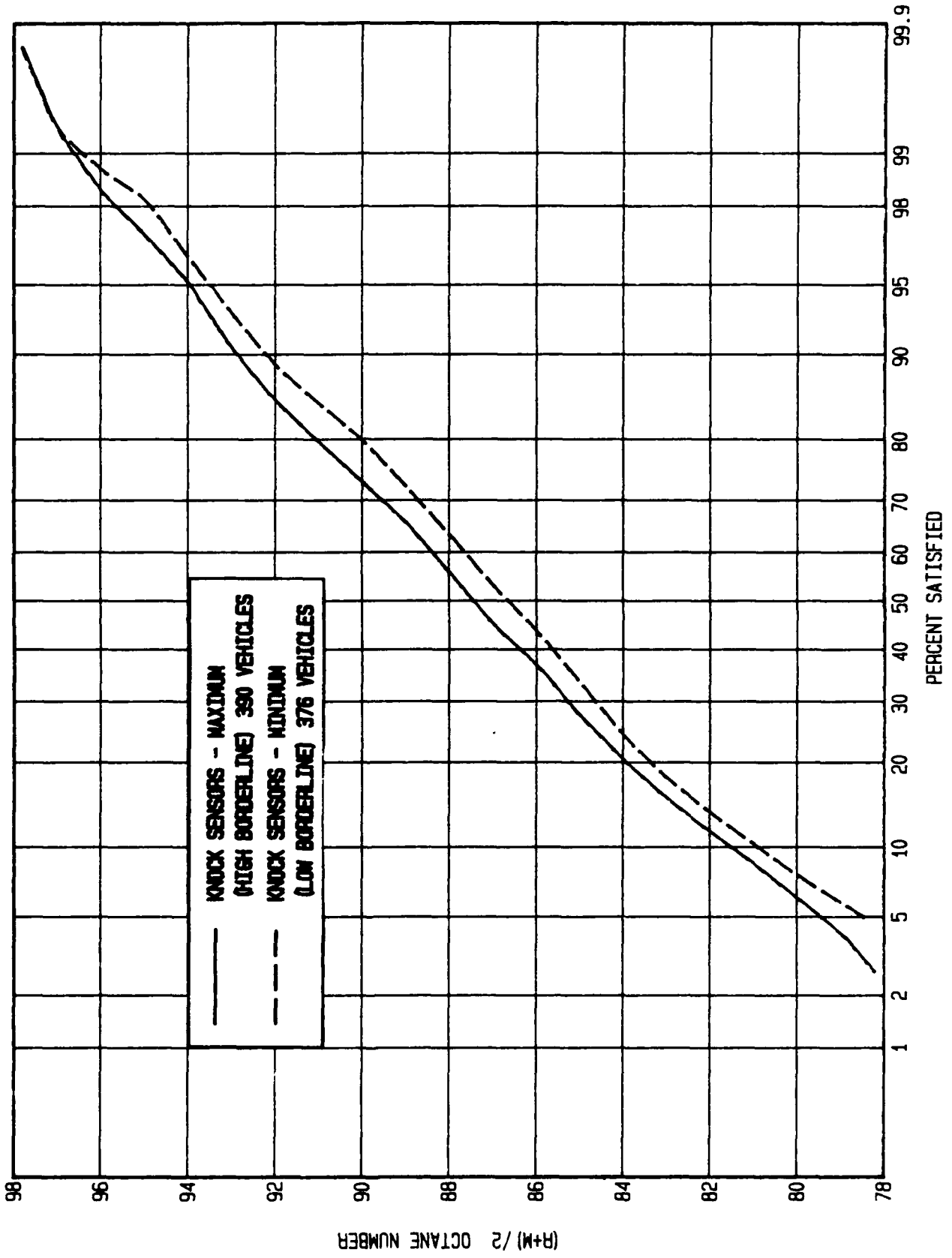


Figure 3
DISTRIBUTION OF MAXIMUM FBRU FUEL (R+M)/2 OCTANE NUMBER REQUIREMENTS
1988 TOTAL VEHICLES

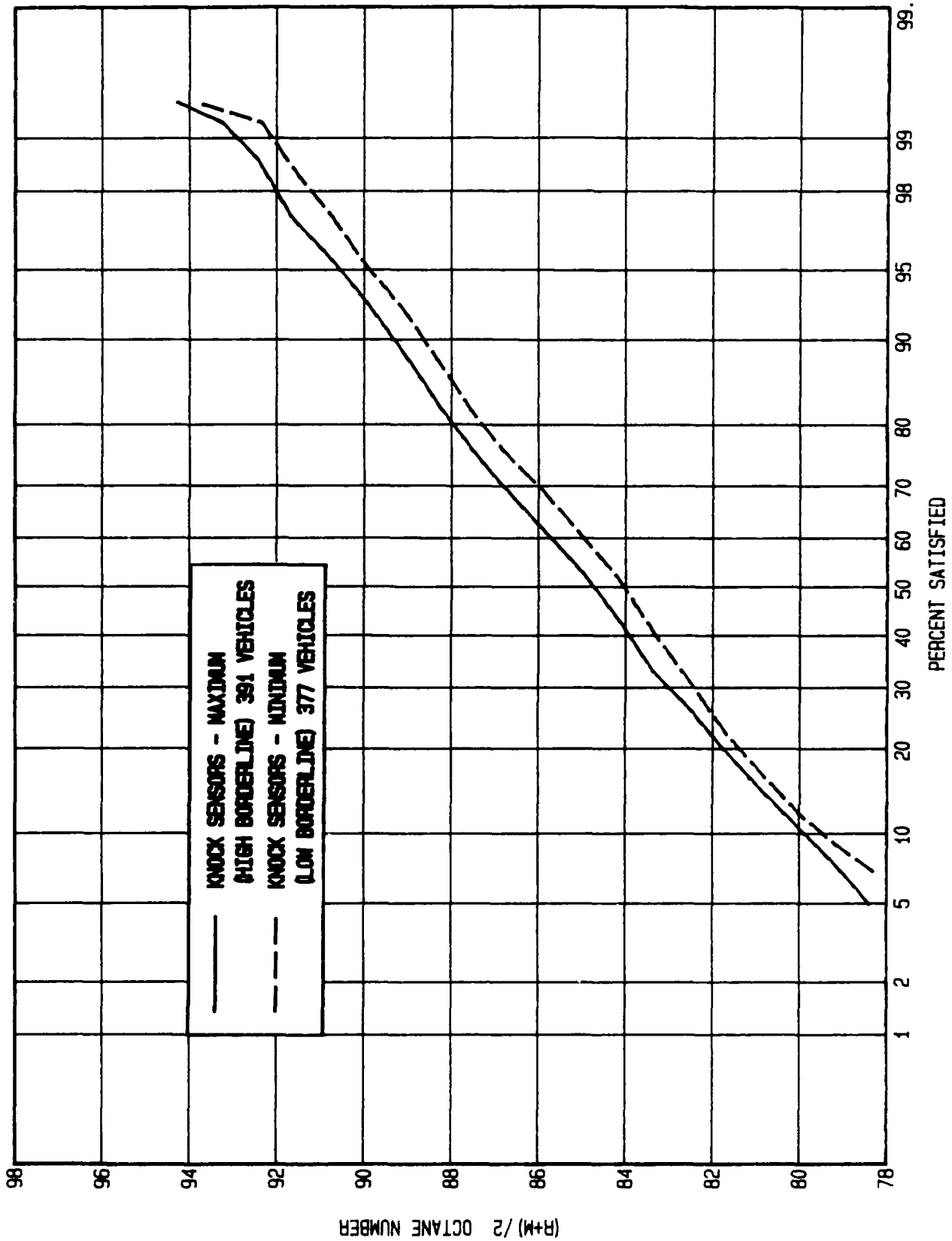


Figure 4
DISTRIBUTION OF MAXIMUM FBRSU FUEL (R+M)/2 OCTANE NUMBER REQUIREMENTS
1988 TOTAL VEHICLES

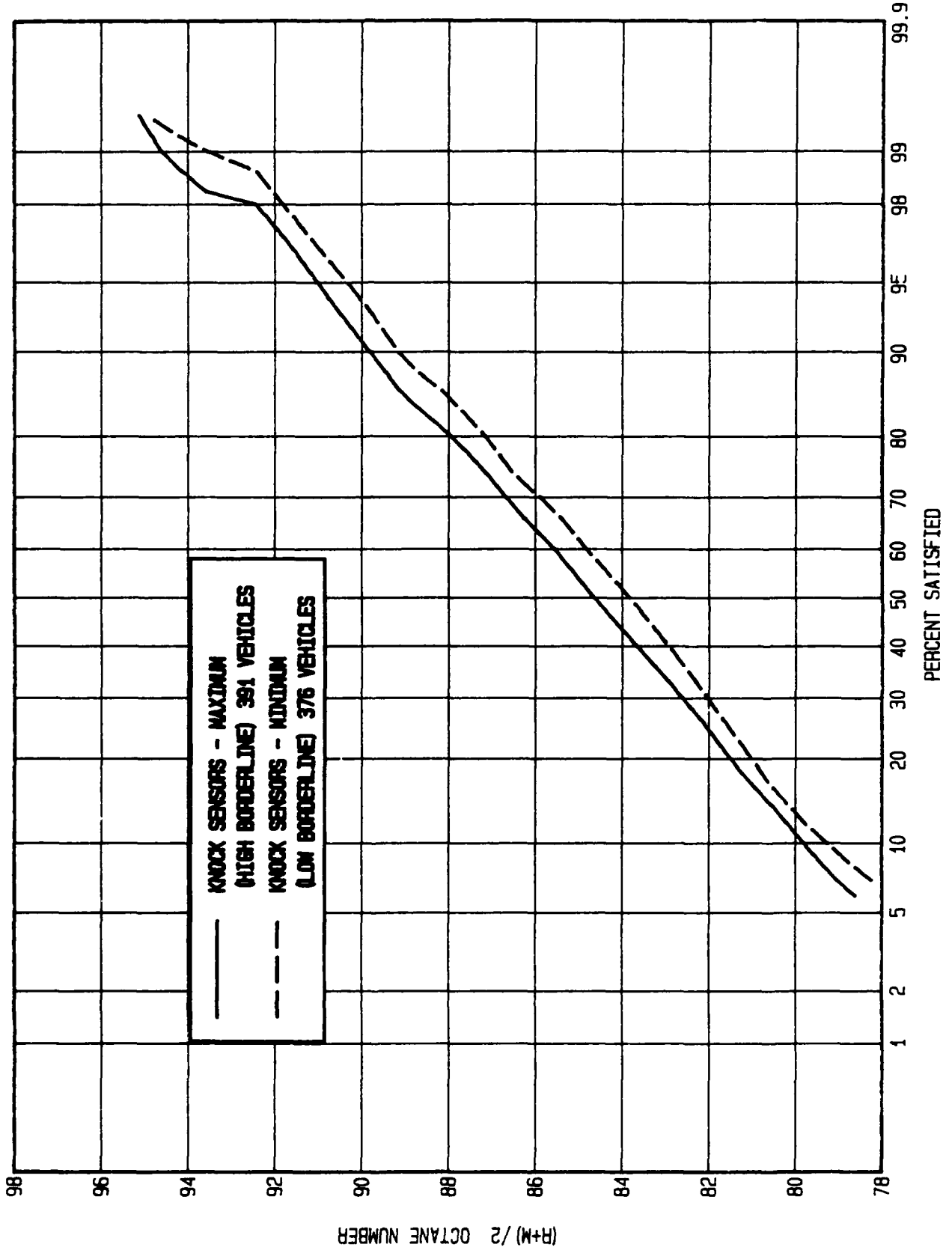


Figure 5
DISTRIBUTION OF MAXIMUM (R+M)/2 OCTANE NUMBER REQUIREMENTS
1988 TOTAL VEHICLES

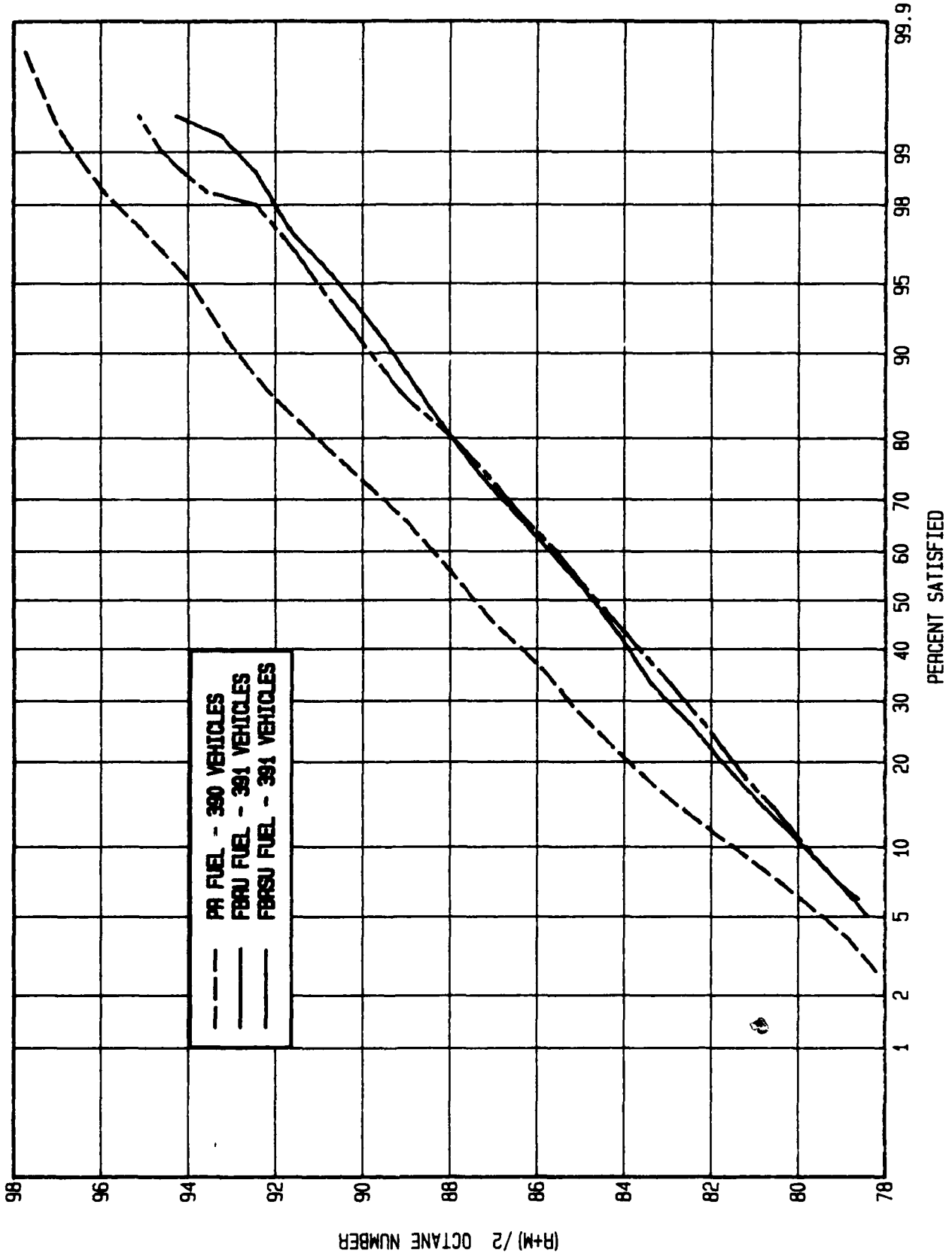


Figure 6
DISTRIBUTION OF MAXIMUM FBRU FUEL (R+M)/2 OCTANE NUMBER REQUIREMENTS
1988 AND 1987 TOTAL VEHICLES

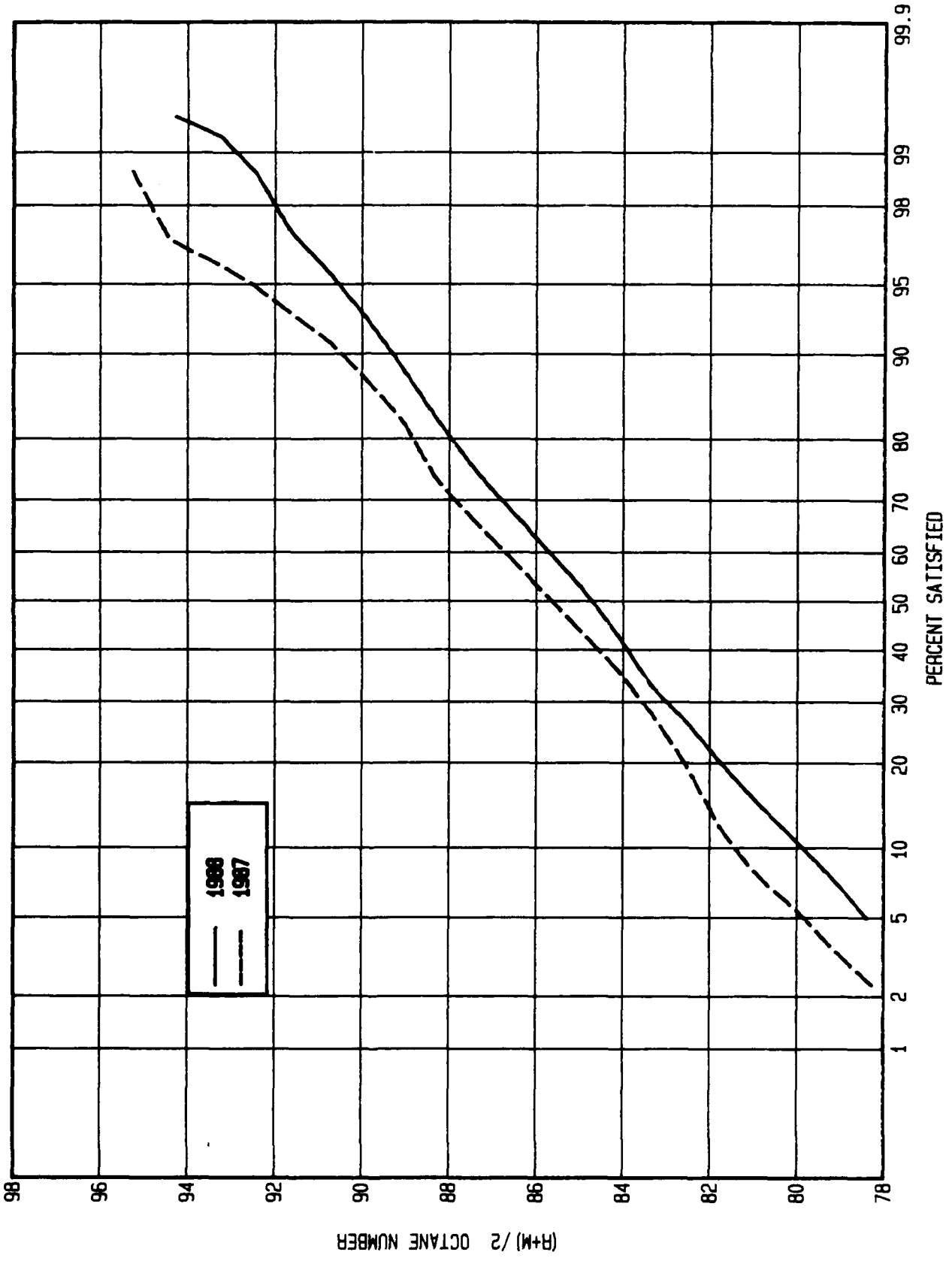


Figure 7
DISTRIBUTION OF MAXIMUM (R+M)/2 OCTANE NUMBER REQUIREMENTS
1988 TOTAL CARS

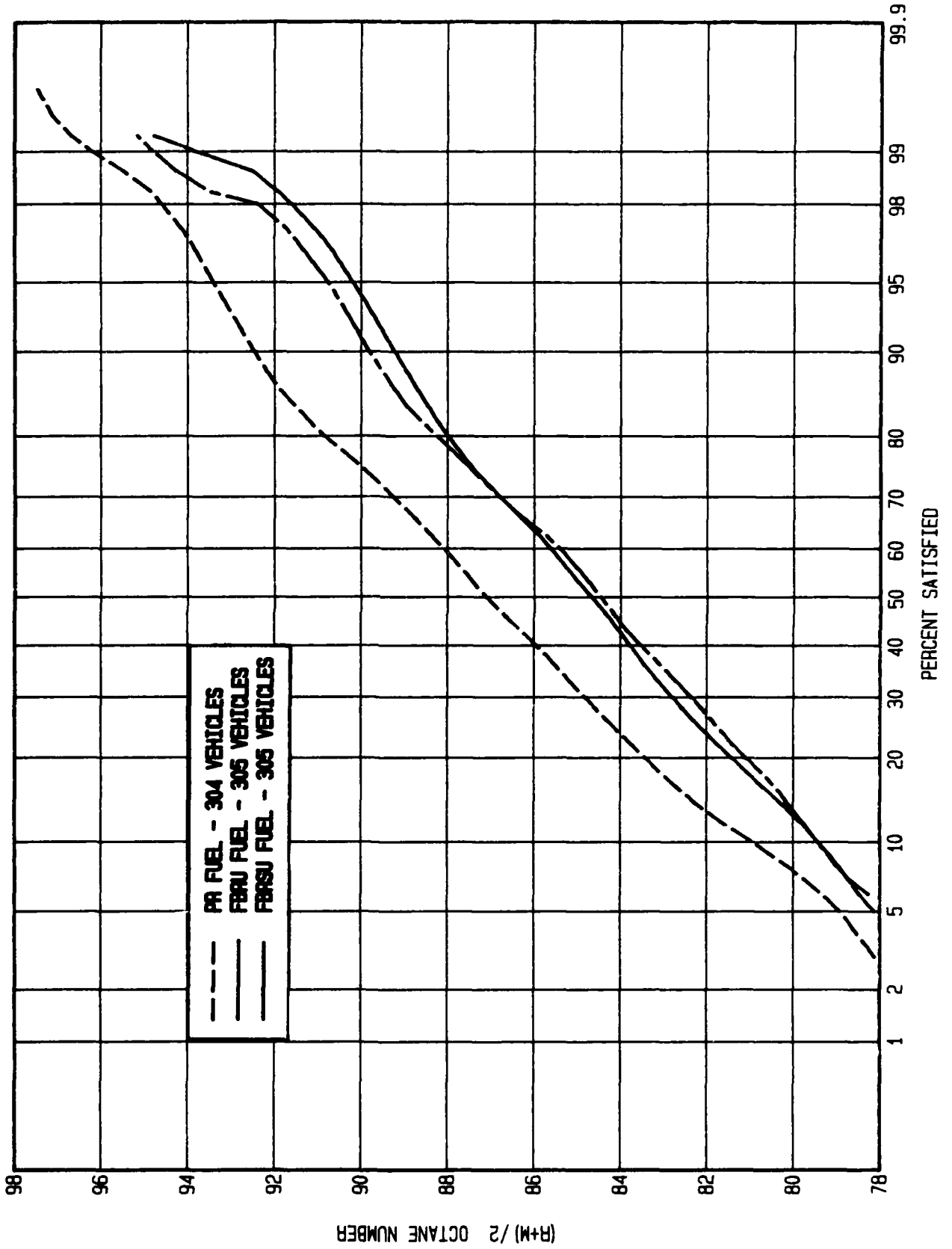


Figure 8
DISTRIBUTION OF MAXIMUM (R+M)/2 OCTANE NUMBER REQUIREMENTS
1988 TOTAL TRUCKS AND VANS

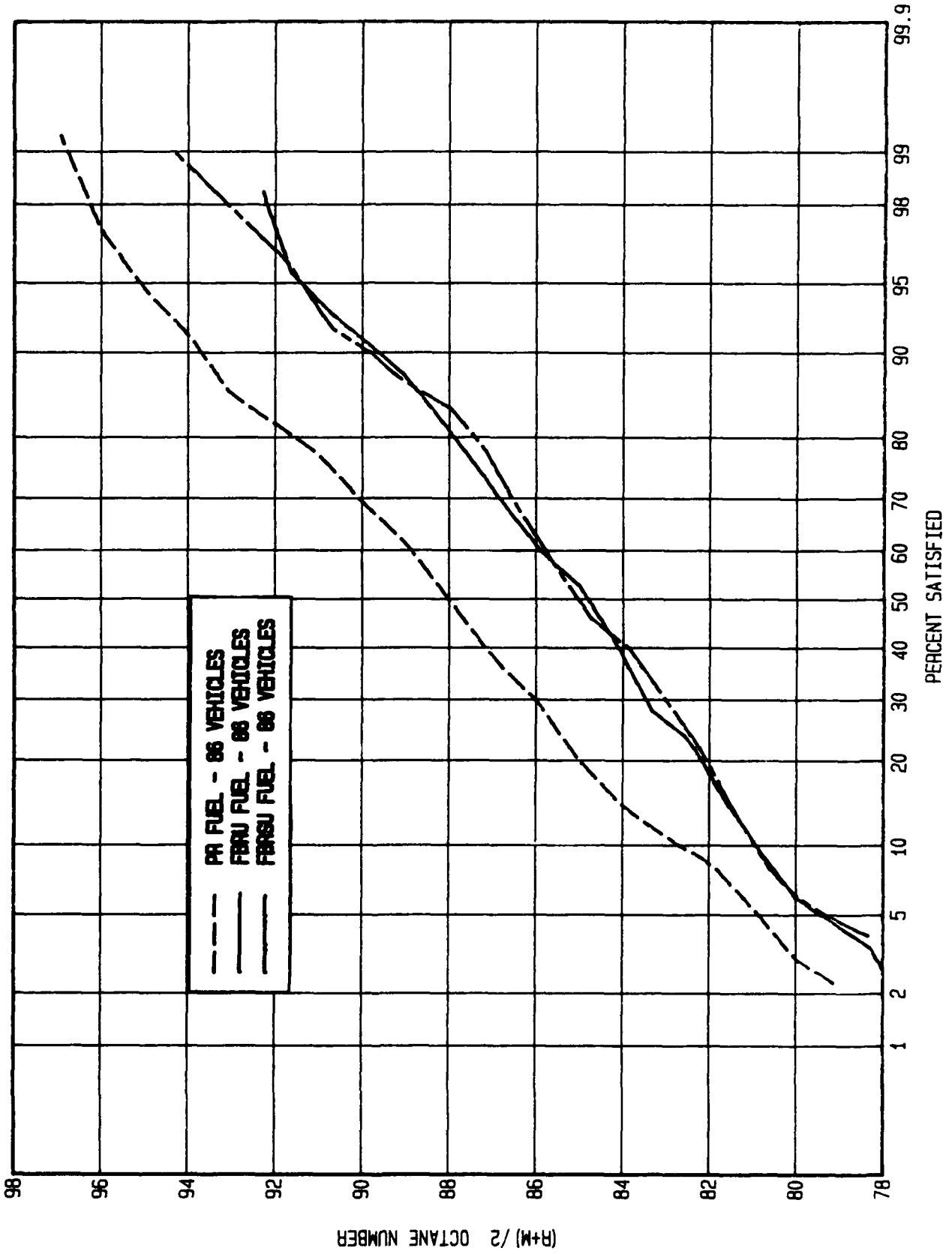


Figure 9
DISTRIBUTION OF MAXIMUM (R+M)/2 OCTANE NUMBER REQUIREMENTS
1988 KNOCK SENSOR VEHICLES - MAXIMUM (HIGH BORDERLINE)

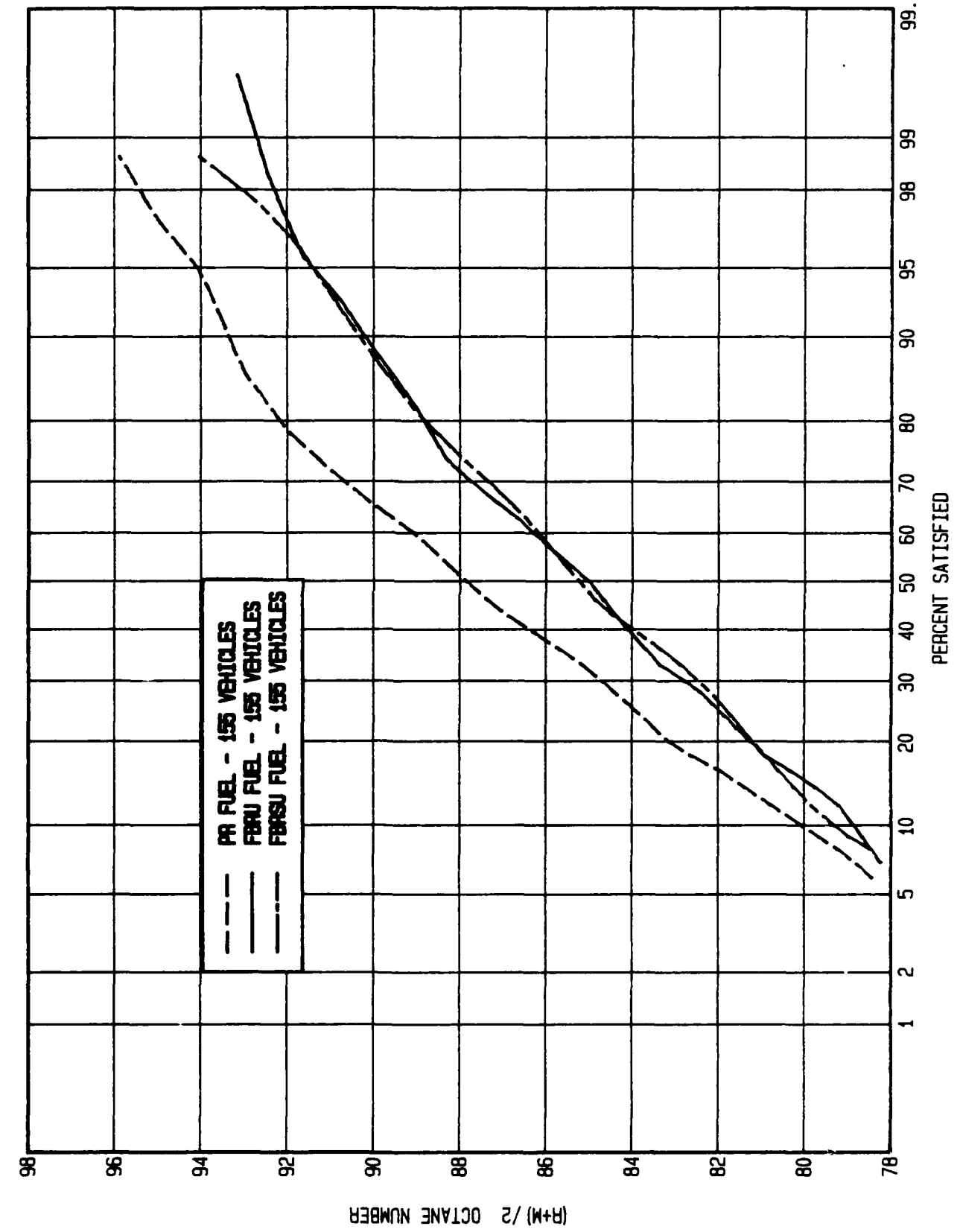


Figure 10
DISTRIBUTION OF MAXIMUM (R+M)/2 OCTANE NUMBER REQUIREMENTS
1988 KNOCK SENSOR VEHICLES - MINIMUM (LOW BORDERLINE)

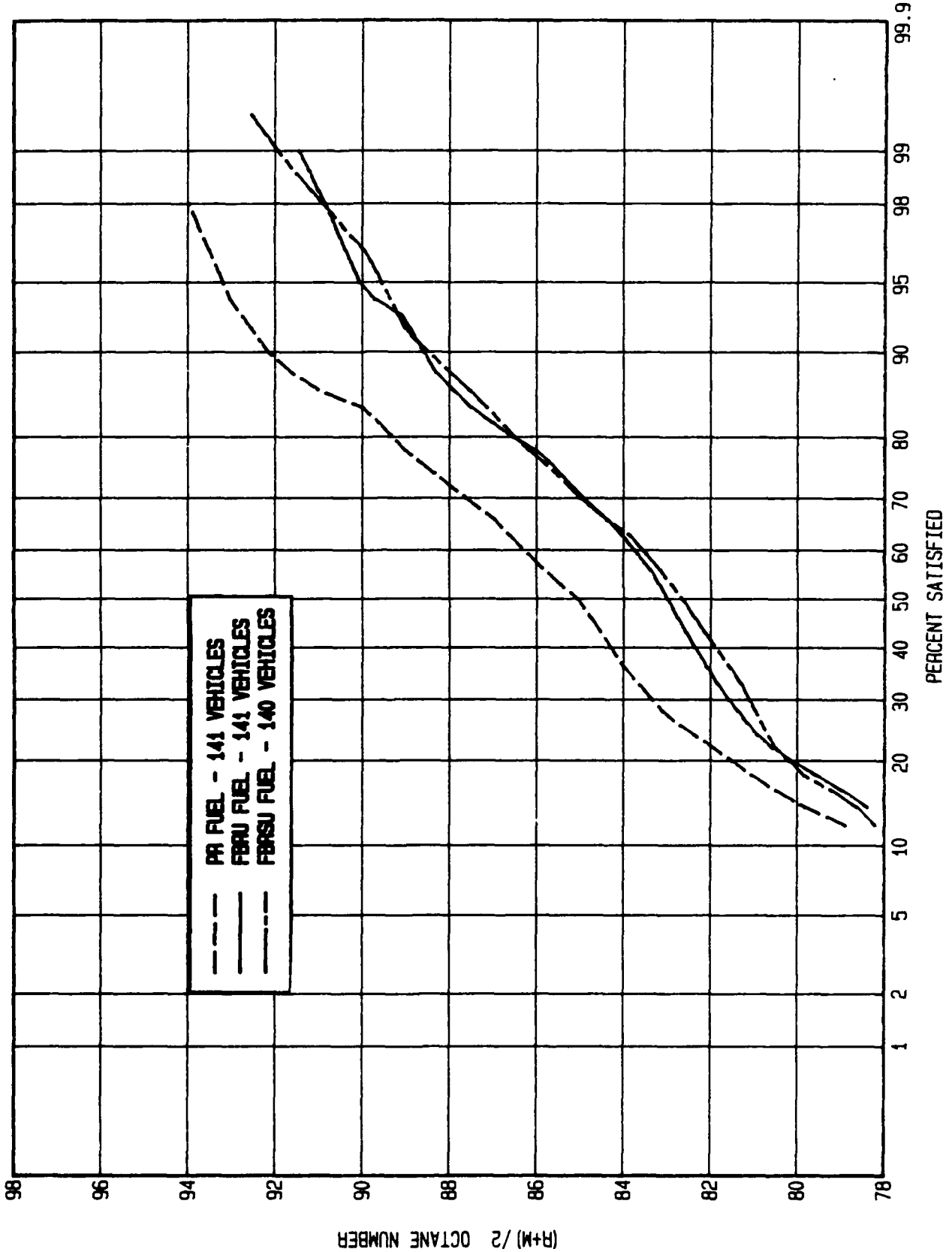
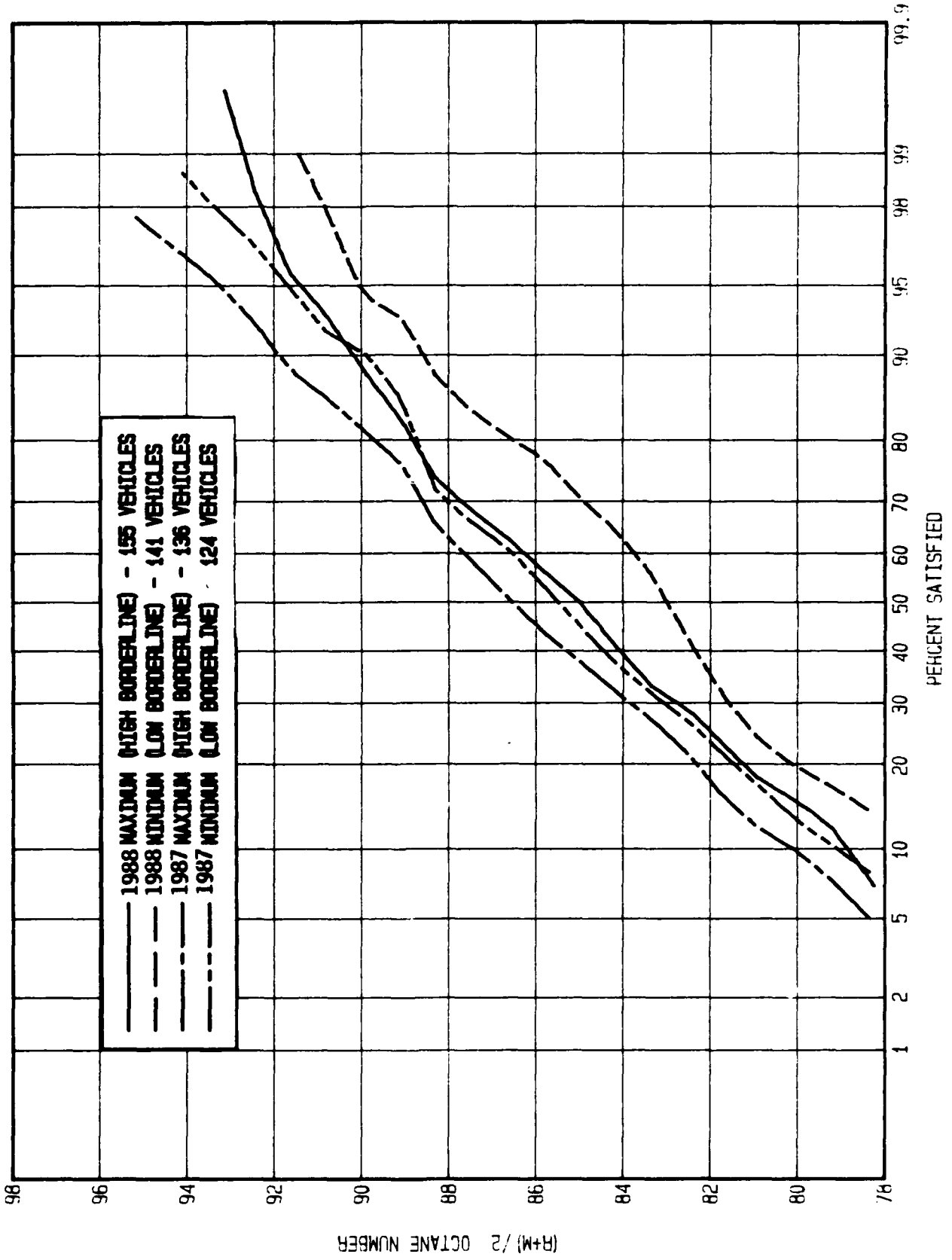


Figure 11
DISTRIBUTION OF MAXIMUM FBRU FUEL (R+M)/2 OCTANE NUMBER REQUIREMENTS
1988 AND 1987 KNOCK SENSOR VEHICLES



A P P E N D I X A

PARTICIPATING LABORATORIES

PARTICIPATING LABORATORIES

No. of Vehicles Tested	Eastern Area	East Central Area	No. of Vehicles Tested
30	Exxon Res. & Engrg. Co. Linden, NJ	Ashland Oil Ashland, KY	2
30	Mobil Res. & Dev. Corp. Paulsboro, NJ	BP Oil Company Cleveland, OH	30
21	Sun Company Marcus Hook, PA	Ford Motor Company Dearborn, MI	30
23	Texaco Inc. Beacon, NY	General Motors Research Labs Warren, MI	30
		MMC Services Ann Arbor, MI	3
		Nissan Res. & Dev. Ann Arbor, MI	11
		Petro-Canada Products Sheridan Park, Ontario	31
		Shell Canada Oakville, Ontario	4
		Toyota Motor Corp. Ann Arbor, MI	10
	Western Area	**West Central Area**	
32	Chevron Research Company Richmond, CA	Chrysler Corporation Detroit, MI	17
28	Unocal Corporation Brea, CA	Amoco Oil Company Naperville, IL	30
		Phillips Petroleum Co. Bartlesville, OK	21
		Shell Development Co. Houston, TX	8

A P P E N D I X B

MEMBERSHIP: 1988 ANALYSIS PANEL

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

1988 ANALYSIS PANEL

Name	Company
D. I. Hoel, Leader	Exxon Research and Engineering Company
W. F. Biller	Consultant
C. J. Bones	Sun Refining and Marketing Company
J. C. Callison	Amoco Oil Company
J. P. Graham	Chevron Reseach Company
M. J. McNally	Mobil Research and Development Corporation
M. T. Noorman	Mobil Oil Corporation
J. P. Uihlein	BP Oil Company (Sohio)
T. Wusz	Unocal Corporation

A P P E N D I X C

DATA ON 1987/1988
FULL-BOILING RANGE REFERENCE FUELS

TABLE C-1

SUPPLIERS' FUEL INSPECTIONS

1987/1988 FBRU FUELS

	Low-Octane Base Blend RMFD 362-87/88	Intermediate-Octane Base Blend RMFD 363-87/88	High-Octane Base Blend RMFD 364-87/88
Laboratory Inspection			
Distillation, °F			
IBP	98	90	92
10% Evap.	137	124	122
30% Evap.	166	163	185
50% Evap.	192	214	237
70% Evap.	230	272	259
90% Evap.	333	353	294
End Point	413	421	388
RVP, psi	7.2	8.4	8.1
Lead, g/gal.	0.000	0.000	0.000
Oxidation Stab., min.	1440+	1440+	1440+
Hydrocarbon Type, Vol. %			
Aromatics	19.8	27.5	51.3
Olefins	13.8	9.6	0.0
Saturates	66.4	62.7	48.7
Research Octane Number	79.2	90.8	103.5
Motor Octane Number	74.7	82.6	91.8
Sensitivity	4.5	8.2	11.7

TABLE C-2

OCTANE NUMBERS AND COMPOSITIONS FOR 1987/1988 FBRU FUELS

Research Octane Number	Volume Percent RMFD 356-87/88	RMFD 357-87/88	RMFD 358-87/88	Motor Octane Number	Sensitivity
80	95.0	5.0	---	74.9	5.1
82	77.5	22.5	---	76.3	5.7
84	60.5	39.5	---	77.7	6.3
85	51.5	48.5	---	78.4	6.6
86	42.5	57.5	---	79.0	7.0
87	34.0	66.0	---	79.7	7.3
88	25.0	75.0	---	80.4	7.6
89	16.5	83.5	---	81.1	7.9
90	7.5	92.5	---	81.7	8.3
91	---	99.5	0.5	82.3	8.7
92	---	92.5	7.5	82.9	9.1
93	---	85.5	14.5	83.6	9.4
94	---	78.0	22.0	84.2	9.8
95	---	70.0	30.0	84.9	10.1
96	---	62.5	37.5	85.6	10.4
97	---	54.5	45.5	86.3	10.7
98	---	46.5	53.5	86.9	11.1
99	---	37.5	62.5	87.8	11.2
100	---	28.5	71.5	88.8	11.2
101	---	19.0	81.0	89.8	11.2
102	---	10.0	90.0	90.8	11.2
103	---	1.5	98.5	91.7	11.3

TABLE C-3

SUPPLIERS' FUEL INSPECTIONS

1987/1988 FBRSU FUELS

	Low-Octane Base Blend RMFD 365-87/88	Intermediate-Octane Base Blend RMFD 366-87/88	High-Octane Base Blend RMFD 367-87/88
Laboratory Inspection			
Distillation, °F			
IBP	100	96	96
10% Evap.	134	128	127
30% Evap.	172	167	184
50% Evap.	204	216	237
70% Evap.	245	277	256
90% Evap.	357	367	304
End Point	417	413	392
RVP, psi	7.3	7.8	7.6
Lead, g/gal.	0.000	0.000	0.000
Oxidation Stab., min.	1440+	1440+	1440+
Hydrocarbon Type, Vol. %			
Aromatics	12.8	27.9	63.3
Olefins	34.7	20.4	1.5
Saturates	52.5	51.7	35.3
Research Octane Number	79.4	90.8	103.2
Motor Octane Number	72.4	80.6	89.5
Sensitivity	7.0	10.2	13.7

TABLE C-4

OCTANE NUMBERS AND COMPOSITIONS FOR 1987/1988 FBRSU FUELS

Research Octane Number	Volume Percent RMFD 356-87/88	RMFD 357-87/88	RMFD 358-87/88	Motor Octane Number	Sensitivity
80	96.0	4.0	---	72.6	7.4
82	78.5	21.5	---	74.0	8.0
84	61.0	39.0	---	75.5	8.5
85	52.0	48.0	---	76.1	8.9
86	43.5	56.5	---	76.7	9.3
87	34.5	65.5	---	77.4	9.6
88	26.0	74.0	---	78.1	9.9
89	17.0	83.0	---	78.8	10.2
90	8.0	92.0	---	79.5	10.5
91	---	99.0	1.0	80.2	10.8
92	---	92.0	8.0	80.9	11.1
93	---	85.0	15.0	81.5	11.5
94	---	77.5	22.5	82.2	11.8
95	---	69.5	30.5	83.0	12.0
96	---	61.0	39.0	83.8	12.2
97	---	52.5	47.5	84.5	12.5
98	---	43.0	57.0	85.4	12.6
99	---	34.0	66.0	86.2	12.9
100	---	25.0	75.0	87.1	12.9
101	---	16.0	84.0	88.0	13.0
102	---	7.0	93.0	88.8	13.2
102.8	---	0.0	100.0	89.5	13.2

APPENDIX D

PROGRAM

COORDINATING RESEARCH COUNCIL
INCORPORATED
219 PERIMETER CENTER PARKWAY
ATLANTA, GEORGIA 30346
(404) 396-3400

PROGRAM

for the

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

CRC Project No. CM-123-88

February 1988

TABLE OF CONTENTS

I. INTRODUCTION

The 1988 program of the CRC Light-Duty Octane Number Requirement Survey Group will consist of a survey of the octane number requirements of 1988 model domestic and imported vehicles. For the purposes of this program, the designation "passenger vehicles" will include passenger cars, light-duty (<8500 lb/3856 kg GVW) pickup trucks, and vans. Approximately 430 vehicles will be tested. Most of these vehicles will be sampled in proportion to their relative production or import volume, to provide data from which to estimate the distribution of octane number requirements for the 1988 model vehicle population in the United States. In addition, select models of special interest will be tested in sufficient numbers to estimate their requirement distributions.

Knocking characteristics will be investigated with three series of reference fuels. Tank fuel knock will also be evaluated. Maximum octane number requirements, whether at maximum-throttle or part-throttle, will be established for each vehicle using high sensitivity unleaded full-boiling range reference (FBRSU) fuels, average sensitivity unleaded full-boiling range reference (FBRU) fuels, and primary reference (PR) fuels. If the maximum requirement is at maximum-throttle, then part-throttle requirements are investigated with only FBRU fuels of up to, and including, four octane numbers lower than the maximum requirement. Also, minimum requirements are determined for knock-sensor equipped vehicles.

II. GEOGRAPHICAL AREAS

As in previous years, the 1988 Survey will be conducted on a nationwide basis. The country has been divided into four geographical areas. Participants located in New York, New Jersey, Delaware, and Pennsylvania have been included in the Eastern Area; those located in Ohio, Michigan, and Kentucky comprise the East Central Area; those in Illinois, Texas, and Oklahoma comprise the West Central Area; and California participants make up the Western Area. A coordinator has been appointed for each area as follows:

Eastern Area.....D. I. Hoel
East Central Area.....J. P. Uihlein
West Central Area.....J. B. Baker
Western Area.....T. Wusz

The area coordinators will contact their area participants periodically regarding the progress of the survey. To expedite this, it is suggested that participants send copies of all correspondence concerning the survey to the area coordinators. This program outlines the survey in broad terms. If more detailed information is desired, it is suggested that the participant contact his area coordinator.

III. VEHICLES

A total of approximately 430 vehicles will be tested in the 1988 Survey. Current experience indicates we can expect about 13 full participants and 6 partial participants. The 430 vehicle total will be divided into two groups: (1) the statistical group, sampled in proportion to US car model production or import volume, and (2) select models of special interest. Approximately 20 of each of these select models are assigned to be tested in order to provide an estimate of the octane requirement distribution of each model. Some of these 20 vehicles will be those already included in the statistical group, and the remainder will be additional vehicles added to the program.

The desired number of vehicles to be tested in each category is as follows:

Statistical Group	350
Additional Select Model Group	80
Total	430

A detailed breakdown of the specific models and the number of each model to be tested will be circulated to the participants in May 1988 after an estimate of vehicle model production has been obtained. Design specifications for select models to be tested in the 1988 Survey are shown in Table D-I. Selection of these vehicles has been based on new or modified design characteristics that might have a significant effect on octane number requirements and high sales volume which allows individual treatment without additional testing.

Wherever possible, specific vehicle assignments to individual participating laboratories will be made in a pattern which tends to minimize data bias. This will be accomplished by apportioning cars of a given model among the four geographical areas, and subsequently among the laboratories within each area, in order to minimize the effect of non-random factors on the results of the Survey.

IV. FUELS

A. Full-Boiling Range Reference Fuels

Two full-boiling range reference fuel series will be used to define the vehicle octane number requirements. The two series will be unleaded and of varying sensitivity. One series will be comparable to the average sensitivity of unleaded commercial fuels (FBRU); the other series (FBRSU) will be a minimum of two numbers higher in sensitivity than the FBRU fuels. The Research octane number (RON) range for both fuel series is 79 to 103.

These fuels will be blended in increments of two RON up to 84, and one RON above 84 from three base fuels for each series. The base fuels are compounded from normal refinery gasoline components. Limiting specifications for each base fuel for both series are shown in Table D-II. These specifications apply to both the 1987 and 1988 Surveys. Supplier inspection data are shown in Table D-III.

Research and Motor ratings have been determined for incremental blends of each fuel series by participants to provide data for establishment of blending curves. The average ratings and blending curves are given in Tables D-IV and D-V.

B. Primary Reference Fuels

Blends of ASTM-grade isooctane and normal heptane will be prepared in two octane number increments from 76 to 82, and one octane number increments from 82 to 100.

C. Tank Gasoline

Research and Motor octane ratings will be obtained only on gasoline samples from the tank of vehicles with owner questionnaire (Attachment 1). Owner's Questionnaire should be obtained if:

a) vehicle has a regular driver; and

b) the ignition timing is within $\pm$ 2° of th manufacturer's specifications.

V. TEST TECHNIQUE

All tests are to be conducted using the technique entitled, "Technique for Determination of Octane Number Requirements of Light-Duty Vehicles" (CRC Designation E-15-88). A copy of this technique is included as Attachment 2 to this program. Octane number requirement investigations are to be conducted in all vehicles under level road conditions. Any vehicle obviously in poor mechanical condition or with malfunctioning emission control devices should not be considered for test work. The vehicles must have a minimum of 6000 deposit miles (9656 km), and preferably be privately owned and operated. Data with less than 6000 miles will not be analyzed. Vehicles previously used for fuel road octane rating must not be employed in this survey.

Data should be reported on each vehicle tested, even though knock was not encountered on any of the fuels.

The order in which the fuels are to be tested is as follows:

1) Tank fuel;
2) FBRSU;
3) FBRU;
4) PR.

VI. DATA FORMS

The test results on each vehicle will be reported on data forms DFMF-11-88 and DFMF-19-88. For knock sensor-equipped vehicles, data forms should be filled out completely for maximum requirements and include vehicle information with minimum requirements. Copies of these forms will be mailed to all participants from the CRC office with instructions for their use. Additional instructions are included in the E-15-88 technique.

VII. REPORTING RESULTS

The original data forms for each vehicle tested should be submitted to William F. Biller, 68 Yorktown Road, East Brunswick, New Jersey 08816, as soon as possible, but not later than October 31, 1988.

TABLE D-I

DESIGN SPECIFICATIONS FOR 1988 SELECT MODELS

Make & Model	Engine Displ. Liters	Configuration & No. of Cylinders	Fuel System	Comp. Ratio	BHP	Knock-Sensor	VIN Engine Code	Trans. Type
GM								
B Car	4.3	V-6	TBI	9.3	140	Yes	Z	A4
A Car	2.5	L-4	TBI	8.3	98	No	R	A4
A and J Cars	2.8	V-6	PFI	8.9	125	Yes	W	A4
Ford								
Tracer	1.6	L-4	PFI	9.3	82	No	5	A3
Ranger	2.9	V-6	PFI	9.0	140	Yes	T	A4
Taurus/Sable	3.0	V-6	PFI	9.25	140	Yes	U	A4
Chrysler								
Trucks	5.2	V-8	TBI	9.2	172	No	--	A3
All but G Cars	2.2 Turbo I	L-4	PFI	8.0	146	Yes	--	A3

TABLE D-II

LIMITING SPECIFICATIONS FOR 1987 AND 1988 FULL-BOILING RANGE REFERENCE FUELS*

Inspection Tests	Unleaded Average Sensitivity Reference Fuels (FBRU)			Unleaded High Sensitivity Reference Fuels (FBRSU)		
	RMFD 362		RMFD 363	RMFD 364	RMFD 365	RMFD 366	RMFD 367
ASTM Distillation, °F(°C)							
IBP, Min.	90	(32.2)	90	90	90	90	90
10% Evap.	115-158	(46.1- 70.0)	115-158	115-158	115-158	115-158	115-158
30% Evap.	150-190	(65.6- 87.8)	150-190	150-190	150-190	150-190	150-190
50% Evap.	195-250	(90.6-121.1)	195-250	195-250	195-250	195-250	195-250
70% Evap.	230-300	(110.0-148.9)	230-300	230-300	230-300	230-300	230-300
90% Evap.	285-374	(140.6-190.0)	285-374	285-374	285-374	285-374	285-374
End Point, Max.	437	(225)	437	437	437	437	437
RVP, psi (KPa)	7-9	(48-62)	7-9	7-9	7-9	7-9	7-9
Lead, g/gal (g/l)	<0.03	(<0.008)	<0.03	<0.03	<0.03	<0.03	<0.03
Oxidation Stability, Minutes, Min.	1440		1440	1440	1440	1440	1440
Hydrocarbon Type, Vol. %							
Aromatics, Max.**	20		35	55	35	45	65
Olefins, Max.	20		15	10	35	25	15
Saturates	Remainder		Remainder	Remainder	Remainder	Remainder	Remainder
Octane Number							
Research	79 ± 1		91 ± 1	104 ± 1	79 ± 1	91 ± 1	104 ± 1
Sensitivity***	4.5 ± .5		8.5 ± .5	11.5 ± .5	6.5 ± .5	10.5 ± .5	13.5 ± .5
Minimum of two units sensitivity difference between corresponding fuels of each series.							
Color	Bronze		Green	Red	Yellow	Deep Purple	Light Blue

Note: All fuels to contain minimum 5 PTB of a 100% active antioxidant and 10 PTB of corrosion inhibitor. No manganese added.
Confirmation of product quality of fuel blends to be approved by a six-laboratory CRC Fuel Acceptance Panel prior to drumming.

* To be compounded from normal refinery components. Oxygenates are not to be used as fuel components.
** 1% maximum Benzene or legal.
*** Sensitivities are shown for the mean Research octane number.

TABLE D-III

SUPPLIER INSPECTION DATA FOR 1987 AND 1988 FULL-BOILING RANGE REFERENCE FUELS*

Inspection Tests	Unleaded Average Sensitivity Reference Fuels (FBRU)			Unleaded High Sensitivity Reference Fuels (FBRSU)		
	RMFD 362	RMFD 363	RMFD 364	RMFD 365	RMFD 366	RMFD 367
ASTM Distillation, °F(°C)						
IBP, Min.	98	90	92	100	96	96
10% Evap.	137	124	122	134	128	127
30% Evap.	166	163	185	172	167	184
50% Evap.	192	214	237	204	216	237
70% Evap.	230	272	259	245	277	256
90% Evap.	333	353	294	357	367	304
End Point, Max.	413	421	388	417	413	392
RVP, psi (KPa)	7.2	8.4	8.1	7.3	7.8	7.6
Lead, g/gal (g/l)	0.000	0.000	0.000	0.000	0.000	0.000
Oxidation Stability, Minutes, Min.	1440+	1440+	1440+	1440+	1440+	1440 Min.
Hydrocarbon Type, Vol. %						
Aromatics, Max.**	19.8	27.5	51.3	12.8	27.9	63.2
Olefins, Max.	13.8	9.6	0.0	34.7	20.4	1.5
Saturates	66.4	62.7	48.7	52.5	51.7	35.3
Octane Number						
Research	79.2	90.8	103.5	79.4	90.8	103.2
Sensitivity***	4.5	8.2	11.7	7.0	10.2	13.7
Color	Bronze	Green	Red	Yellow	Purple	Light Blue

TABLE D-IV

COMPOSITIONS AND OCTANE NUMBERS

FOR CRC 1987-88 FBRU REFERENCE FUELS

Research Octane Number	Volume Percent RMFD 362-87	RMFD 363 87	RMFD 364-87	Motor Octane Number	Sensitivity
80	95.0	5.0	---	74.9	5.1
82	77.5	22.5	---	76.3	5.7
84	60.5	39.5	---	77.7	6.3
85	51.5	48.5	---	78.4	6.6
86	42.5	57.5	---	79.0	7.0
87	34.0	66.0	---	79.7	7.3
88	25.0	75.0	---	80.4	7.6
89	16.5	83.5	---	81.1	7.9
90	7.5	92.5	---	81.7	8.3
91	---	99.5	0.5	82.3	8.7
92	---	92.5	7.5	82.9	9.1
93	---	85.5	14.5	83.6	9.4
94	---	78.0	22.0	84.2	9.8
95	---	70.0	30.0	84.9	10.1
96	---	62.5	37.5	85.6	10.4
97	---	54.5	45.5	86.3	10.7
98	---	46.5	53.5	86.9	11.1
99	---	37.5	62.5	87.8	11.2
100	---	28.5	71.5	88.8	11.2
101	---	19.0	81.0	89.8	11.2
102	---	10.0	90.0	90.8	11.2
103	---	1.5	98.5	91.7	11.3

TABLE D-V

COMPOSITIONS AND OCTANE NUMBERS

FOR CRC 1987-88 FBRSU REFERENCE FUELS

Research Octane Number	Volume Percent RMFD 365-87	RMFD 366 87	RMFD 367-87	Motor Octane Number	Sensitivity
80	96.0	4.0	---	72.6	7.4
82	78.5	21.5	---	74.0	8.0
84	61.0	39.0	---	75.5	8.5
85	52.0	48.0	---	76.1	8.9
86	43.5	56.5	---	76.7	9.3
87	34.5	65.5	---	77.4	9.6
88	26.0	74.0	---	78.1	9.9
89	17.0	83.0	---	78.8	10.2
90	8.0	92.0	---	79.5	10.5
91	---	99.0	1.0	80.2	10.8
92	---	92.0	8.0	80.9	11.1
93	---	85.0	15.0	81.5	11.5
94	---	77.5	22.5	82.2	11.8
95	---	69.5	30.5	83.0	12.0
96	---	61.0	39.0	83.8	12.2
97	---	52.5	47.5	84.5	12.5
98	---	43.0	57.0	85.4	12.6
99	---	34.0	66.0	86.2	12.8
100	---	25.0	75.0	87.1	12.9
101	---	16.0	84.0	88.0	13.0
102	---	7.0	[illegible]	88.8	13.2
102.8	---	0.0	[illegible]	89.6	13.2

CRC OCTANE NUMBER REQUIREMENT SURVEY

OWNER'S QUESTIONNAIRE

OWNER:

Your vehicle is being tested for fuel octane number requirements by a Coordinating Research Council activity. To help analyze the data, we would like the person who has recently been driving the vehicle to answer the following questions:

1. What grade of unleaded fuel was purchased the last two times?

☐ Regular ☐ Mid-Grade ☐ Premium

2. Has any engine knock (ping) been encountered with the fuel that is now in the tank?

☐ Yes ☐ No

3. Did you consider the knock (ping) objectionable?

☐ Yes ☐ No

Vehicle Make _____ License No. _____

Vehicle Identification No. _____

Company Testing Vehicle _____

Attachment 2

TECHNIQUE FOR DETERMINATION OF OCTANE NUMBER REQUIREMENTS OF LIGHT-DUTY VEHICLES

(CRC Designation E-15-88)

September 1987

TECHNIQUE FOR DETERMINATION OF OCTANE NUMBER REQUIREMENTS OF LIGHT-DUTY VEHICLES

(CRC Designation E-15-88 - Including Annex A)

A. GENERAL

The technique provides for the determination of maximum octane number requirements (and minimum octane number requirements for vehicles equipped with knock sensors), whether at maximum-throttle or part-throttle, of a vehicle in terms of borderline spark knock on two series of full-boiling range reference fuels as well as on primary reference fuels. If the maximum requirement is at maximum-throttle, then part-throttle requirements are investigated with only FBRU fuels of up to, and including, four octane numbers lower than the maximum requirement.
Knock intensity on tank fuel will be measured.

B. DEFINITION OF TERMS

The following definitions of knock, approved by the CLR and CFR Committees on June 8, 1954, have been rephrased for clarification and adaptability to current technology by the Survey Steering Panel.

1. Spark Knock:

Spark knock is the noise associated with the autoignition* of a portion of the fuel-air mixture ahead of the advancing flame front. It is recurrent and repeatable in terms of audibility and fuel octane quality. This includes knock occurring when going from road load to other operating conditions (e.g., tip-in, etc.).

2. Knock Intensity

a. Borderline Knock

This means spark knock of lowest audible intensity of at least three (3) pings, and over a range of engine speed of at least 50 rpm, all being repeatable during subsequent accelerations.

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* Autoignition: The spontaneous ignition and the resulting very rapid reaction of a portion or all of the fuel-air mixture. The flame speed is many, many times greater than that which follows normal spark ignition. There is no time reference for autoignition.

b. No Knock

This means either no audible knock or knock less than borderline intensity.

c. Above Borderline Knock

This means spark knock of greater than borderline intensity.

3. **Octane Number Requirements**

a. Maximum Requirement

This is equivalent to the octane number of the highest reference fuel giving borderline knock as previously defined (the next higher fuel gives no knock). If the knock intensity with the highest fuel giving knock is above borderline, the maximum requirement shall be equivalent to the mid-point between the octane number of the fuel giving knock and that of the next higher fuel which gives no knock.

b. Minimum Requirement (for vehicles with knock sensors)

This is equivalent to the octane number of the lowest reference fuel giving borderline knock (the next lower fuel will give above borderline knock). If the knock intensity with the lowest fuel giving knock is above borderline and the next highest fuel is no knock, then the minimum requirement is the mid-point between the two.

4. **Definition of Accelerations**

Accelerations are made at maximum-throttle and part-throttle conditions which are defined below:

a. Maximum-Throttle

The throttle is depressed and held at either full-throttle or the widest throttle position that does not cause the transmission to downshift (detent) throughout the acceleration in each of the required test gears listed in D.3.d.(1)(a). The detent manifold vacuum/pressure obtainable on a given model is determined by the transmission characteristics. For manual transmissions, the throttle is depressed fully throughout the acceleration.

b. Part-Throttle

The throttle is depressed and regulated throughout the accelera tion to maintain a desired, constant critical manifold vacuum/pressure as defined in D.3.d.(1)(d).

C. VEHICLE PREPARATION

The following vehicle preparation steps should be completed before any octane tests are run. Detailed procedures for each adjustment can be found in the manufacturers' shop manuals.

1. Record vehicle identification number and emission control type, Federal, Altitude, California, or Fifty-State. Fill in headings on both sheets of data form DFMF-11-88. Ford emission calibration numbers are to be recorded.

2. Inspect all vacuum lines and air pump hoses for appropriate connections. Also, check to see if PCV valve, spark advance vacuum delay controls, EGR valve, knock sensors, and heated inlet air mechanism are functioning. Engine must be warmed up for these checks.

3. Check engine idle speed and observe anti-dieseling solenoid operation. Adjust to manufacturers' recommended specifications as specified on the under-hood decal.

4. Observe and record basic spark timing at recommended engine speed. Adjust to manufacturers' recommended setting as specified on the under-hood decal.

5. Crankcase oil, radiator coolant, automatic transmission fluid, and battery fluid levels shall be maintained as recommended by the manufacturer.

6. A calibrated tachometer graduated in 100 rpm (or smaller) increments and capable of indicating engine speed from 0-5000 rpm shall be installed on the vehicle.

7. One calibrated vacuum gage, graduated in one-half inch of mercury (or smaller) increments and capable of indicating vacuum from 0-24 inches of mercury (0-81 kPa) shall be connected to the intake manifold. For vehicles with turbochargers, a compound vacuum/pressure gage should be used; the pressure side of the gage should be capable of indicating pressures up to 15 psig (103 kPa).

8. An auxiliary fuel system shall be provided to supply test fuels to the engine. Caution shall be taken to avoid placing auxiliary fuel lines in locations which promote vapor lock. If vehicles with carbureted engines have tank return fuel lines, this return line should be blocked off. Disconnect fuel tank vent line at evaporation control system canister. Instructions for the auxiliary fuel system used with fuel injection are given in Annex A.

9. For vehicles with owner questionnaire completed, a sample of the tank gasoline shall be withdrawn for determination of Research and Motor method octane number ratings. If insufficient fuel is available, omit this step and obtain tank fuel observations as described in Item D.3.d.(2).

D. TEST PROCEDURE

1. Engine Warm-Up

a. To stabilize engine temperatures, a minimum of ten miles of warm- up is required. The test vehicle should be operated at 55 mph (88 kph) in top gear with a minimum of full-throttle operation.

b. During the warm-up period, the general mechanical condition of the vehicle should be checked to insure satisfactory and safe operation during test work.

2. Fuel Changeover

To eliminate contamination of the new fuel with residual amounts of the previous fuel, fuel-injected systems should be flushed once with new fuel and carburetted systems should be flushed twice. Fuel handling procedures for vehicles equipped with fuel injection systems are explained in Annex A.

After fuel changeover, make one maximum-throttle acceleration before beginning Vehicle Rating Procedure.

3. Details of Observations

a. Operating Conditions

All octane number requirements will be determined under level road acceleration conditions.

Tests will be conducted on moderately dry days, preferably at ambient temperatures between 60°F (15.5°C) and 90°F (32.2°C). Tests should not be conducted during periods of high humidity such as prevail when rain is threatening or during or immediately after a rain storm. Laboratories with control capabilities should target for 70°F (21°C) air temperature and 50 grains of water per pound (7.14 gm/kg) of dry air whenever possible.

Air-conditioned vehicles will be tested with air conditioner turned ON. (Normal setting, minimum temperature, low fan.) Air conditioner will be ON at all times.

b. Order of Fuel Testing

1) Tank
2) FBRSU
3) FBRU
4) Primary

c. Determination of Knock Intensity

Maximum octane requirements will be established by evaluating the occurrence of knock in terms of knock intensity: "N" for none, "B" for borderline, and "A" for above borderline. Establishment of representative knock intensity for a given fuel will be accomplished with a maximum of three (3) rated accelerations. Coast-down time between the end of one acceleration and the beginning of the next should be approximately twenty (20) seconds. As defined below, the first two duplicating accelerations are sufficient with "N" and "B" intensity.

Acceleration Number			Representative Rating
1	2	3	
N	N	-	N
N	B	N	N
N	B	B	B
B	N	B	B
B	B	-	B
B	A	-	A
A	-	-	A

All subsequent accelerations will normally be discontinued when "A" knock intensity is experienced, and testing continued with a higher octane number fuel in that series. An exception will be made if "A" knock is experienced on the highest octane fuel which knocks in the engine. In this case, it may be necessary to run additional accelerations to determine the speed of maximum knock intensity. If "A" knock is experienced at initiation of acceleration, as limited by transmission characteristics, this speed will be considered the speed of maximum knock. Otherwise, the midpoint between knock-in and knock-out will be considered the speed of maximum knock. When establishing knock-in and knock-out, back off on the throttle between points to eliminate "A" knock.

Minimum octane number requirements for vehicles equipped with knock sensors will be established in a similar manner except that when "A" knock intensity is encountered, subsequent accelerations will be made with a given fuel until duplicate "A" ratings are obtained over a measurable range of engine speeds as indicated below:

Acceleration Number			Representative Rating
1	2	3	
B	A	B	B
B	A	A	A
A	A	-	A
A	B	B	B

d. Determination of Octane Requirements

Tests should be run to 70 mph (113 kph). If required to terminate at lower speed, termination speed should be noted on data sheet.

(1) Vehicle Operating Procedure

(a) Establishment of Automatic Transmission Characteristics

Determine the minimum attainable road speed, and obtain the transmission downshift characteristics of engine rpm and manifold vacuum/pressure from minimum speed at 25, 35, 45, 55, and 65 mph (40, 56, 72, 88 and 104 kph) as applicable (as obtainable in each gear), by movement of the throttle through the detent, i.e., downshift, throttle position. These characteristics are to be determined for each of the gears specified in the table below. For transmissions with converter clutches, determine the minimum road speed for clutch application. At this initial speed and at 10 mph (16 kph), increments up to about 60 mph (97 kph) determine minimum vacuums (pressures) for application. Record all road speed/engine rpm/vacuum or pressure measurements from above on data sheet.

Do not use brakes, turn signals or hazard flashers during accelerations as these may affect electronic engine controls.

The selection of required test gears, and test gear/converter clutch combinations (if applicable) for various types of transmissions are shown in Table T-I. Transmissions not explicitly described should be tested in a manner as similar as possible to those listed. Automatic transmission vehicles should be tested with the gear selector in D or O; top gear should not be locked out. Transmissions equipped with electronic overdrive should be operated in overdrive. Transmissions equipped with power/normal selection should be operated in the normal position.

TABLE T-I

TRANSMISSION GEAR SELECTION

AUTOMATICS

Place the selector in "D" or "O" and check for critical condition.

Type	Gears to be Tested
GM 4-speed	4th gear, converter clutch engaged
	3rd gear, converter clutch engaged
	3rd gear, converter clutch disengaged
	2nd gear, converter clutch disengaged
GM 3-speed/ Chrysler 3-speed with converter clutch	3rd gear, converter clutch engaged
	3rd gear, converter clutch disengaged
	2nd gear, converter clutch disengaged
Ford Front-Wheel Drive:	
4-speed overdrive	4th gear, converter clutch engaged
	4th gear, converter clutch disengaged
	3rd gear, converter clutch engaged, if applicable
	3rd gear, converter clutch disengaged
	2nd gear
Ford Rear-Wheel Drive:	
4-speed overdrive	4th gear, converter clutch engaged, if applicable
	4th gear, converter clutch disengaged
	3rd gear, converter clutch engaged, if applicable
	3rd gear, converter clutch disengaged
	2nd gear
Other 3-speed	3rd gear
	2nd gear

MANUALS

5-speed	4th and 3rd gears
4-speed	4th and 3rd gears
3-speed	3rd and 2nd gears

(b) Maximum-Throttle Accelerations - Automatic Transmissions

For maximum-throttle accelerations in each of the gears and gear/converter clutch combinations specified above, accelerate at the detent/application condition according to the speed versus vacuum/pressure profiles determined in (a) from the minimum obtainable speed up to 70 mph (113 kph). If the transmission downshifts, abort and start the acceleration again. Start with the highest gear or gear/clutch combination and proceed in descending order.

(c) Maximum-Throttle Accelerations - Manual Transmissions

Select the highest gear as specified in the table above. Start at the lowest speed from which the vehicle will accelerate smoothly or 25 mph (40 kph), whichever is higher, and depress the throttle full throughout the acceleration up to 70 mph (113 kph).

Select the next lower gear specified in the table above and accelerate at full throttle from the minimum speed from which the vehicle will accelerate smoothly up to 70 mph (113 kph).

(d) Part-Throttle Accelerations for Both Automatic and Manual Transmissions

Select the highest gear as specified in Table T-I for manual transmissions. Select the two highest gears as specified in Table T-I for automatic transmissions. For example, on a four-speed automatic transmission, check both fourth locked and unlocked and third locked and unlocked; on a three-speed automatic transmission, check third locked and unlocked and second. For auto matic transmissions with converter clutches use the highest gear up to the minimum vehicle speed at which the converter clutch will engage, and the highest gear/converter clutch combination above this minimum speed, to obtain the critical part-throttle vacuum or pressure. To obtain the critical part-throttle vacuum/pressure, first operate at constant speed road load, at 25, 35, 45, 55, and 65 mph (40, 56, 72, 88, and 105 kph) incremental speeds if obtainable in the specified gear. At each speed, move the throttle in approximately 3 seconds from the road-load vacuum to the positions described below for naturally aspirated and turbocharged engines:

1. for naturally aspirated vehicles, one inch Hg (3.4 kPa) above:

   a. full-throttle vacuum for manual transmissions;

   b. detent vacuum for automatic transmissions without converter clutches;

   c. the minimum vacuum at which the converter clutch disengages for so-equipped automatic transmissions.

2. for turbocharged vehicles, one psi (3.4 kPa) below:

   a. full-throttle maximum boost for manual transmissions;

   b. maximum boost at detent for automatic transmissions without converter clutches;

   c. maximum boost or 0.5 psig (1.7 kPa) above the minimum vacuum at which the converter clutch disengages for so-equipped automatic transmissions.

   Use of vehicle brakes should be avoided.

   If knocking occurs within any of the vacuum/pressure ranges, establish the manifold vacuum/pressure which gives maximum knock intensity on each fuel series. This is the critical vacuum/pressure to be used for all subsequent constant-vacuum/pressure part-throttle accelerations from the minimum obtainable speed in the test gear to 70 mph (113 kph), or until the vehicle ceases to accelerate. This critical vacuum/pressure should be determined for each reference fuel series.

(2) Tank Fuel Observations

Investigate for maximum-throttle and part-throttle knock as detailed in Item 3d(1). Define maximum knock intensity as per Item 3c. Record maximum knock intensity, speed of maximum knock intensity, and manifold vacuum/pressure at each operating condition.

(3) Vehicle Rating Procedure

All initial accelerations should be started from minimum obtainable gear/converter clutch combination at constant level road-load conditions. Knock rating should be performed while in a normal upright seated position with floor mats in place.

Step 1 - After Tank Fuel Observations, use a fuel estimated to give borderline knock in a given fuel series and investigate for incidence of knock under conditions as described in D.3.d.(1)(b) above, and D.3.d.(1)(c) above, whichever is applicable.

Step 2 - If no knock occurs, go to a lower octane number blend in that series and repeat Step 1.

Step 3 - If knock occurs at one or more of the operating conditions in Step 1, continue investigation at the critical condition(s) with higher octane blends until highest octane fuel giving knock is determined within one octane number or one blend (the next higher fuel giving no knock). Record maximum knock intensity on all fuels. Record speed of maximum knock intensity and manifold vacuum/pressure on highest octane fuel that knocks.

Step 4 - Using the lowest octane blend that did not knock in Step 3, investigate for incidence of part-throttle knock as described in D.3.d.(1)(d). If knock occurs, continue investigation at critical vacuum/pressure until requirement is defined. Record maximum knock intensity and critical manifold vacuum/pressure on all fuels, and speed of maximum knock intensity on highest octane fuel that knocks.

Step 5 - With FBRU fuel only, if no knock occurs in Step 4, go to a lower octane number blend and repeat Step 4. Discontinue part-throttle investigation if knock is not observed with a fuel four octane numbers lower than determined in Step 3.

Step 6 - For knock-sensor equipped vehicles after determination of maximum requirement, continue with lower octane blends until the lowest octane fuel giving borderline knock is determined (the next lowest fuel giving above borderline knock).

The rating procedure is given in arrow diagram form on page D-26 for maximum requirement, and on page D-27 for minimum requirement, for knock sensor-equipped cars.

E. INTERPRETATION OF DATA

The data will be recorded on data sheets DFMF-11-88 and DFMF-19-88. Data Form DFMF-11-88 has provisions for recording both the maximum and minimum requirements of knock-sensor equipped vehicles on the same sheet. Additional data sheets for recording run data may be appended to DFMF-11-88 as needed. Octane requirements for all reference fuels shall be determined as follows:

1. If the knock intensity of the highest reference fuel giving knock is borderline, the requirement shall be reported as the octane number of that fuel.

2. If the knock intensity of the highest fuel giving knock is above borderline, the requirement shall be reported as the mid-point between the octane number of the fuel giving knock and that of the next higher fuel.

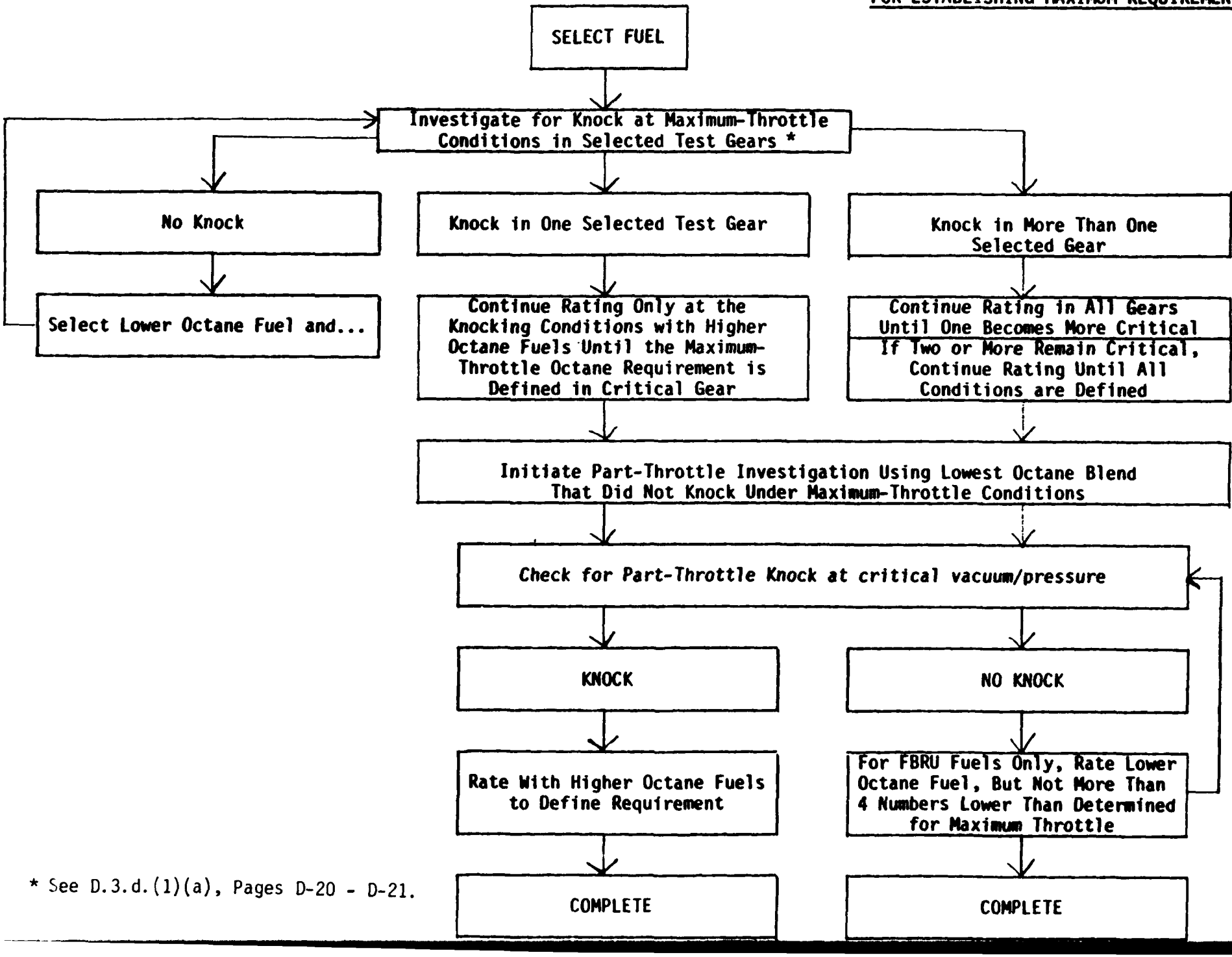
3. If the octane requirement in high gear is equal to the requirement in a lower gear, report the highest gear data.

4. For part-throttle requirements, report the data from the critical manifold vacuum/pressure observations.

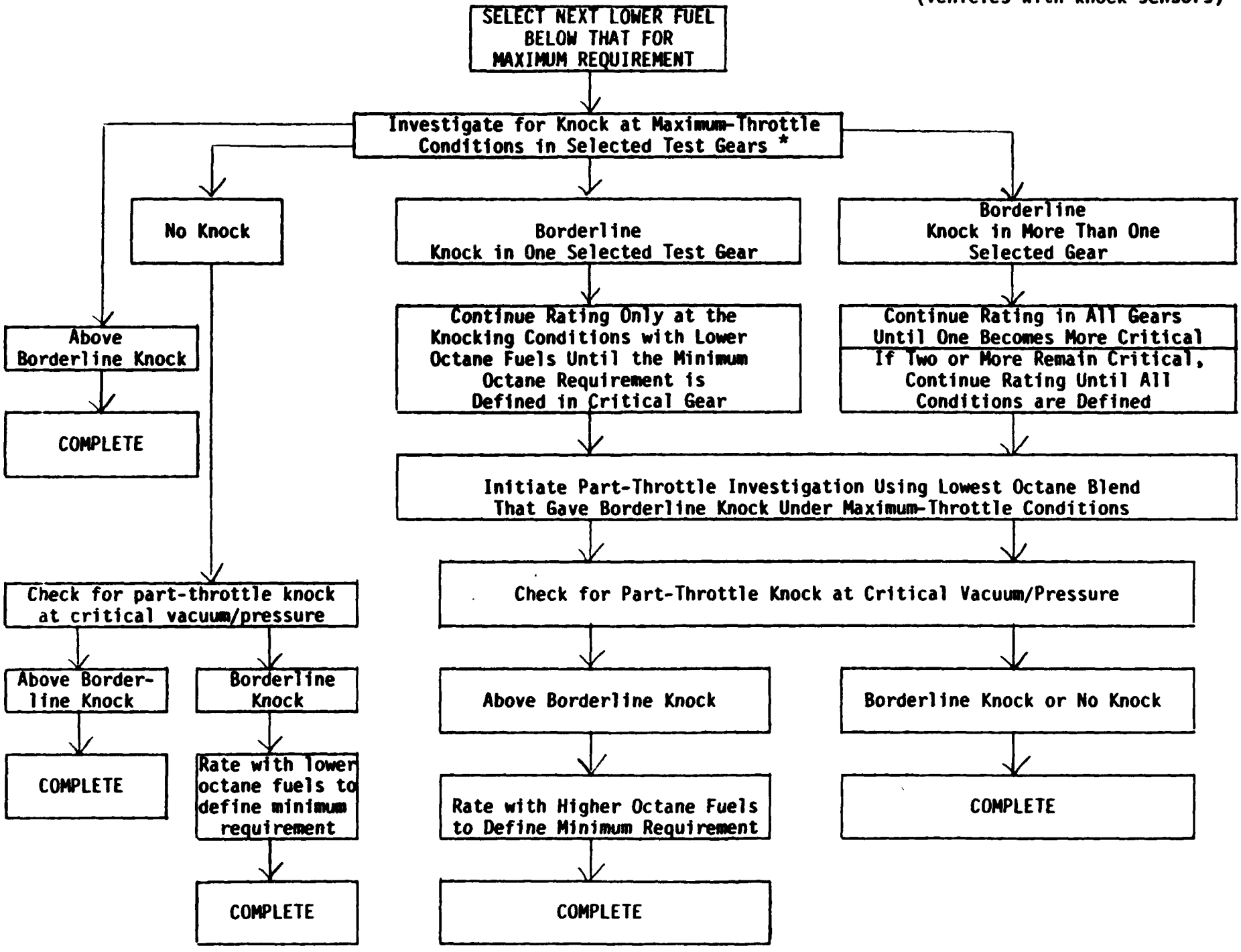
5. For knock-sensor equipped vehicles, report the highest and lowest fuel giving borderline knock. If the knock intensity with the lowest fuel giving knock is above borderline and the next highest fuel is no knock, then the minimum requirement is the mid-point between the two.

Record data on all fuels tested, even though knock was not encountered. The octane number requirement summary block on the first sheet of DFMF-11-88 provides space for both the maximum and the minimum requirements of knock-sensor equipped vehicles. When transferring data to the summary block, record maximum-throttle and part-throttle octane number requirements in the appropriate blocks. The higher of the two will be selected by the computer as the maximum octane number requirement. If both maximum-throttle and part-throttle requirements are equal, then the computer will select the part-throttle requirement as the maximum octane number requirement. Use proper letter designation (see footnotes on data sheet) to designate: (1) requirements outside of the reference fuel limits; (2) FBRU part-throttle requirement more than four numbers below maximum; and (3) all other cases for which the octane number requirement has not been determined. Note that in the case of a converter-clutch equipped vehicle, test gear numbers should indicate whether the converter clutch was locked or unlocked. Note also that in the case of turbo-equipped vehicles, a manifold pressure above atmospheric is indicated as a <u>negative</u> number in units of psig.

It is important that the vehicle identification number (VIN) of each vehicle tested be recorded on all data sheets to provide a means of cross-indexing.



* See D.3.d.(1)(a), Pages D-20 - D-21.



* See D.3.d.(1)(a), Pages D-20 - D-21.

ANNEX A

to the

CRC E-15-88 TECHNIQUE

PROCEDURE FOR SETTING UP VEHICLES WITH FUEL INJECTION

ANNEX A

PROCEDURE FOR SETTING UP VEHICLES AND HANDLING REFERENCE FUELS: VEHICLES EQUIPPED WITH FUEL INJECTION

1. To run octane requirements on fuel-injected vehicles, it is necessary to install an external fuel supply line with auxiliary electric fuel pump from the reference fuel can to the vehicle fuel system and an external return line back to the reference fuel can.

2. There are two types of fuel injection systems: throttle-body injection, and multi-port injection. As a general description, the systems will contain the following parts:

   Fuel Tank
   High- or Low-Pressure In-Tank Fuel Pump
   Fuel Supply Line(s)
   In-Line Filter(s)
   High-Pressure Chassis-Mounted Pump (not required for all vehicles)
   Fuel Rail (to supply multiple injectors on port fuel injection)
   Fuel-Pressure Regulator (integral on throttle-body, on fuel rail with multi-port injection; controls pressure at the injectors).

   Depending upon the vehicle's specific fuel system and/or tester's preference, installation of the required auxiliary equipment can be accomplished in a variety of ways.

3. The auxiliary fuel supply line may be installed anywhere between the fuel tank and the inlet at the throttle-body or fuel rail. The auxiliary fuel return line may be installed anywhere between the fuel- pressure regulator outlet and the tank.

4. After connections have been broken, the fuel lines on the fuel tank side should be capped and the vehicle's pump(s) disconnected or disarmed. Alternately, an additional fuel line can be looped between the supply and return lines and the vehicle pump(s) allowed to circulate fuel directly back to the fuel tank. Caution should be exercised if this alternate technique is used. A high pressure will build up in the tank due to the large amount of vapors generated.

   The auxiliary fuel supply system must be capable of supplying fuel at a pressure slightly higher than the maximum fuel pressure required (at wide-open-throttle on normally aspirated engines or at maximum mani fold boost pressure on turbocharged or supercharged engines) by the particular vehicle being tested. This is to overcome any line losses and thus insure accurate results. This may be accomplished by using an adjustable high-pressure pump, or by using a low-pressure pump to supply fuel to the chassis-mounted high-pressure pump if the testing lab chooses to keep it in the system. A fuel filter may be required between the auxiliary pump and the reference fuel can to protect the pump. The fuel return line should be connected to a tee at the auxiliary pump inlet. The reference fuel can should be vented to outside the vehicle.

It is possible to use three-way valves in the fuel line between the fuel pump and the fuel tank and between the return line and the fuel tank. When used, the operator must change the return line valve to the auxiliary fuel system while the engine is shut down, to avoid building up excessive pressure in the return line which could damage both the fuel-pressure regulator and injection pump.

5. When changing from one reference fuel can to another, the following steps should be followed:

   a. Disconnect fuel inlet line from reference fuel can and run engine a short time; do not run out of fuel since this will introduce air into the fuel injection system and excessive cranking will be required to restart the engine.

   b. With the engine shut off, disconnect the fuel return line from the auxiliary pump inlet and connect it to a slop can. Connect the fuel supply line to the new reference fuel can and run the engine long enough to purge the old reference fuel from the system. The time required will be dependent upon length of added fuel lines, but it will be approximately 30-60 seconds; approximately 1-2 quarts of fuel will be discarded to slop.(1)

   c. With the engine off, connect the fuel return line to the auxiliary pump inlet. The vehicle is then ready to be tested.

   d. When changing to the next reference fuel, it is necessary to repeat Steps a, b, and c.

CAUTION

Fuel supply lines remain pressurized long after the engine is shut off; be sure to relieve the pressure before disconnecting fuel lines.

Use fuel lines designed for high pressure. They should be rated for at least 250 psi working pressure and for 1000 psi burst pressure.

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(1) It is critical to circulate an adequate amount of fuel to the slop can to prevent reference fuel contamination.

CAUTION - (Continued)

The engine and auxiliary fuel pumps should be shut off while changing from auxiliary to tank fuels.

Purging procedures should be followed strictly to preclude reference fuel contamination or discarding more fuel than is required.

Vehicle pump(s) may be disarmed by use of the inertia switch if so equipped. The voltage supplied to the inertia switch may then be used to power the auxiliary pump. When making these electrical connections, do not "splice" into the wire; instead, connect the wire lead to the connector.

Do not disarm the vehicle fuel pump by removing the fuse, since other accessories may be connected to the same circuit; instead, disconnect the fuel pump electrical lead.

Auxiliary fuel return lines should be of a size large enough to prevent a build-up of back pressure which could prevent the proper operation of the pressure regulator.

Use of the "rolled edge" style hose clamps, such as those made by Chrysler, is recommended to prevent damage to fuel lines.

Note: Diagnostic scanners should not be used while knock testing.

A P P E N D I X E

1988 OCTANE NUMBER REQUIREMENT SURVEY DATA

GLOSSARY

(For Appendix E Only)

Emission Certification (EMCT):	A	Altitude
	C	California
	F	Federal
	B	Both California and Altitude
	E	Everything
Knock Sensor (KNK SEN):	Y	Yes
	N	No
Air Conditioner:	Y	Yes
	N	No
Spark Advance:	+	Before Top Center
	-	After Top Center
Test Fuel:	1	Tank Fuel
	2	FBRSU
	3	FBRU
	4	PR
Octane Number Requirements: (expressed as Research ON)	L	Less than lowest available ON for FBRU and FBRSU fuels and less than 76 for PR fuels
	H	Higher than highest available ON for FBRU and FBRSU fuels and higher than 100 ON for PR fuels
	F	Part-throttle requirement greater than four numbers below maximum-throttle requirement
Throttle (THR):	M	Maximum
	P	Part
Gear:	1-5	Manual and Automatic
	U	Not tested in lockup (torque converter not engaged)
	L	Tested in lockup (torgue converter engaged)
Manifold Vacuum (MV):	Inches Hg, positive (+) for vacuum, negative (-) for pressure	
Owner-Reported Knock (OWKNK):	Y	Yes, Not Objectionable
	O	Objectionable
	N	No
Rater-Reported Noise Intensity (NINT):	N	None
	B	Borderline
	A	Above Borderline

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

VEHICLE DESCRIPTION									WEATHER			OCTANE NUMBER REQUIREMENT DATA								TANK FUEL INFORMATION								
															MAXIMUM			PART THROTTLE							RATER		
					SPARK ADVANCE																							
OBS NO	MODEL CODE	EMCT	KNK SEN	C.R.	AIR	AS RCD	AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	OCT NO	AGER	RPM	MV	OCT NO	AGER	RPM	MV	GWKN	OCT NO RES	OCT NO MOT	GNIT	GTHR	GEAR	RPM	MV
47-18	ACE3 P16M5	C	N	9.5	Y	+12	+12	11700	70	30.05	50	3	89.0	4	2500	0.0	87.0	4	2500	1.0								
												2	89.0	4	3000	0.0												
												4	89.0	4	2800	0.0												
28-23	BFA P18M4	F	Y H	9.0	Y	+ 6	+ 6	10478	70	29.10	50	3	82.0	3	2700	1.0	L							N				
			H									2	84.0	3	3700	1.0												
			H									4	79.0	3	2500	1.0												
			L									3	L															
			L									2	82.0	3	3700	1.0												
			L									4	76.0	3	2500	1.0												
65-15	BGA P18A3	F	Y H	10.0	N			9656	75	29.44	76	3	95.5	3	3000	0.5	94.0	3	3000	4.0								
			H									2	96.0	3	3000	0.5												
			H									4	93.0	3	3000	0.5												
			L									3	95.5	3	3000	0.5												
			L									2	95.5	3	3000	0.5												
			L									4	92.5	3	3000	0.5												
25-08	DC3 P30A3	F	N	8.9	Y	+12	+12	13044	70	29.49	50	3	85.0	2U	2600	0.5	81.0	2U	2500	1.5				N				
												2	86.0	2U	2600	0.5												
												4	83.0	2U	2900	0.5												
05-19	DC3 P30A3	F	N	8.9	Y	+12	+12	14728	70	30.21	50	3	92.0	3U	2700	1.4					N	98.6	88.4	B	M	3U	2700	1.4
												2	92.0	3U	2750	1.4												
												4	90.0	3U	2750	1.4												
25-01	DEETP22A3	F	Y H	8.1	Y	+12	+12	8651	70	29.40	50	3	85.0	2	2400	-7.5	82.0	2	2400	-5.0				N				
			H									2	85.0	2	2400	-7.5												
			H									4	85.0	2	2400	-7.5												
			L									3	83.0	2	2500	-7.5	83.0	2	2400	-5.0								
			L									2	83.0	2	2600	-7.5												
			L									4	83.0	2	2400	-7.5												
25-09	DHETP22A3	F	Y H	8.1	Y	+12	+12	10982	70	29.60	50	3	84.0	3	3100	-6.5	83.0	3	2600	-0.5				N				
			H									2	86.0	3	3200	-6.5	85.0	3	2600	-0.5								
			H									4	85.0	2	3100	-8.0												
			L									3	81.0	3	3100	-6.5												
			L									2	82.0	3	3100	-6.5												
			L									4	84.0	2	3100	-8.5												

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMCT	KNK SEN	C.R.	AIR	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	CWKN	RATER OCT RES	RATER OCT MOT	RATER INTR	RATER GEAR	RATER RPM	RATER MV
06-07	DHETP22A3	F	Y H	8.1	Y	+11	+10	10483	66	29.96	39	3	82.0	3	2800	6.0	82.0	3	2800	5.0							
			H									2	85.0	2	3000	6.0											
			H									4	82.0	3	2800	6.0											
			L									3	82.0	3	2800	6.0											
			L									2	85.0	3	3000	6.0											
			L									4	82.0	3	2800	6.0											
25-10	DJK T25A3	F	N	9.0	Y	+10	+12	16636	70	29.52	50	3	80.0	3L	2000	1.5								N			
												2	81.0	2U	2200	0.5											
												4	79.0	3U	2000	1.5											
25-02	DMP 252A3	F	Y H	9.1	Y	+ 6	+ 6	13232	70	29.48	50	3	80.0	3U	1500	3.0	L							N			
			H									2	80.0	3U	1550	3.0											
			H									4	76.0	3U	1450	3.0											
			L									3															
			L									2															
			L									4	75.0	3U	1500	3.0											
05-01	DMP 252A3	F	Y H	9.1	Y	+ 7	+ 7	7463	70	30.10	50	3	93.0	3U	1650	2.3					Y	91.9	82.6	A	M	3U	1600	2.4
			H									2	94.0	3U	1650	2.3											
			H									4	91.0	3U	1600	2.3											
			L									3	92.0	3U	1650	2.3											
			L									2	94.0	3U	1650	2.3											
			L									4	90.0	3U	1600	2.3											
62-01	EAP T16A3	E	N	9.4	Y	+ 7	+ 7	10977	70	29.37		3	87.5	2U	1900	1.0	87.5	2U	1700	3.0				N			
												2	89.5	2U	1700	1.0											
												4	87.5	2U	1800	1.0	88.0	2U	1550	1.5							
05-13	EAP T16A3	F	N	9.4	Y	+ 7	+ 7	8761	70	30.20	26	3	89.0	2U	2800	1.5	F										
												2	90.0	2U	2750	1.5											
												4	88.0	2U	2750	1.5											
65-06	EAP T16A3	F	N	9.4	N	+ 7	+ 7	7150	84	29.43	110	3	87.5	3U	2750	1.5	85.0	3L	2750	3.0							
												2	87.0	3U	2750	1.5											
												4	87.5	3U	2750	1.5											
06-20	EAP T16A3	F	N	9.4	Y	+ 7	+ 7	41924	60	29.85	45	3	88.0	3L	2950	0.4	88.0	3L	2650	1.4							
												2	89.0	3L	2950	0.4											
												4	89.0	3L	2900	0.4											
41-14	EAP T16M5	C	N	9.4	N	+ 7	+ 7	6521	70	29.97	68	3	84.0	4	3200	1.0					N	91.6	83.4	N			
												2	84.0	4	3200	1.0											
												4	83.0	4	3200	1.0											

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMC T	KNK SEN	SPARK ADVANCE C.R.	SPARK ADVANCE AIR	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	DWELL KNK	RATER OCT NO RES	RATER OCT NO MOT	RATER KNK TRK	RATER GEAR	RATER RPM	RATER MV
62-04	SBH P20A4	F	N	8.5	Y	+15	+15	12284	70	29.60		3	89.5	3U	2700	0.4	89.0	3U	2100	1.2				B	M	3U	2700	0.4
												2	88.0	2U	2700	0.0	89.0	3U	2500	1.2								
												4	88.0	2U	2400	0.0												
62-07	ECC T16A4	F	N	9.4	Y			8960	72	29.44		3	93.0	3U	2700	0.0	92.0	3U	2600	1.5				A	M	3U	2700	0.0
												2	93.0	3U	2600	0.0												
												4	92.0	3U	2600	0.0												
28-27	ECP T16M5	F	N	9.4	N	+ 7	+ 7	11782	70	29.47	50	3	87.0	4	2300	0.5	86.0	4	1700	1.5	N							
												2	87.0	4	2400	0.5												
												4	87.0	4	1900	0.5												
62-03	EDP P20A4	F	N	8.5	Y	+15	+15	9777	76	29.21		3	96.0	4L	2200	0.6	96.0	4U	2200	2.0				A	M	4U	2200	1.5
												2	96.0	4U	2100	2.0												
												4	95.0	4U	2000	2.0												
65-14	EEH P30A3	F	N	9.0	Y	+20	+20	8350	77	29.38	60	3					87.0	4L	2000	2.0								
												2	88.0	4L	2000	0.5												
												4	86.0	4L	2000	0.5												
62-02	EEH P30A4	F	N	9.0	Y	+20	+20	21589	70	29.40		3	86.0	3U	2100	0.8	85.0	4L	2000	1.5				N				
												2	86.0	2U	2400	0.0												
												4	86.0	3U	2100	0.8												
28-13	EEH P30A4	F	N	9.0		+20	+20	10993	70	29.27	50	3	85.0	3U	2100	1.0	84.0	3U	2000	1.0				N				
												2	85.5	3U	2000	1.0												
												4	84.0	2U	2000	0.5												
62-11	EFCTP30A4	F	Y	H	8.3	Y	+15	+15	6101	70	29.81	32	3	88.0	3U	3000	-5.8	87.0	4L	2400	-2.0				N				
				H									2	89.0	2U	3600	-5.8												
				H									4	87.5	2U	3600	-2.9												
				L									3	87.0	4L	2300	-5.8												
				L									2	88.0	2U	3800	-3.9												
				L									4	87.0	2U	3600	-2.9												
23-05	GC5 T45A4	F	N	9.0	Y	+10	+10	14989	58	29.12	48	3	89.0	4L	1500	2.2	89.0	4L	1500	3.0	N			N				
												2	89.0	4L	1500	2.2												
												4	88.0	4L	1500	2.2												
23-23	GC5 T45A4	F	N	9.0	Y	+10	+10	15929	40	29.04	29	3	89.0	3U	2400	1.2	89.0	4L	1500	4.0	N			N				
												2	90.0	3U	2500	1.2												
												4	88.0	4L	1500	2.0												
07-07	GC5 T45A4	F	N	9.0	Y	+10	+10	11668	73	29.90	58	3	92.0	2U	3100	1.0	92.0	3L	2500	7.0	N	94.3	93.0	N				
												2	94.0	3U	2800	1.5												
												4	89.0	3L	1800	2.0												

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	ENG CT	KNK SEN	SPARK ADVANCE AIR C.R.	SPARK ADVANCE AIR RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OWRN	RATER OCT NO RBS	RATER OCT NO MOT	RATER KNK TR	RATER GEAR	RATER RPM	RATER MV
41-04	GC5 T45A4	C	N	9.0	Y	+10	+10	14030	69	30.00	70	3	92.0	4L	1800	3.0				N			B	M	4L	1900	3.0
												2	93.0	4L	1800	3.0										
												4	91.0	4L	1800	3.0										
08-18	GDY 450A4	F	Y	H	8.0	Y	+20	+20	16537	82	29.64	81	3	86.0	4L	1350	2.0	F					N			
				H									2	99.0	2U	2950	0.5									
				H									4	84.0	4L	1250	2.0									
				L									3	84.0	4L	1350	2.0									
				L									2	86.0	2	2900	0.5									
				L									4	80.0	4L	1300	2.0									
23-10	GDY 450A4	F	Y	H	8.0	Y	+18	+20	8083	64	28.92	49	3	93.0	2U	2800	1.0	F			N		A	M	2U	2500	1.0
				H									2	95.0	2U	3000	1.0									
				H									4	91.0	2U	2000	1.0									
				L									3	90.0	2U	2800	1.0									
				L									2	92.0	2U	3000	1.0									
				L									4	88.0	2U	1900	1.0									
23-19	GK5 T45A4	F	N		9.0	Y	+10	+10	6086	48	29.20	32	3	86.0	4L	1600	2.5	87.0	3U	2400	5.0	N			N			
													2	86.0	4L	1600	2.5	87.0	3U	2600	5.0							
													4	86.0	4L	1600	2.5										
23-26	HAR T25A3	F	N		8.3	Y			13618	50	29.03	22	3	90.0	3U	2700	0.8	90.0	3U	2900	4.0	N			N			
													2	92.0	3U	2700	0.8	92.0	3U	2800	4.0							
													4	85.0	3U	2700	0.8										
47-20	HAR T25A3	C	N		8.3	Y			8700	70	30.09	50	3	91.0	3L	2600	0.8	93.0	3L	1600	7.5							
													2	96.0	2U	4600	0.5										
													4	86.0	3L	2200	0.8										
06-09	HAR T25A3	F	N		8.3	Y			12550	78	29.79	103	3	92.0	3L	1850	1.0	96.0	3U	2850	4.0							
													2	93.0	3L	1800	1.0	100.0	3U	2700	4.0							
													4	87.0	3U	3000	1.0										
46-06	HAR T25A3	F	N		8.3	Y			9668	70	29.40	90	3	88.0	3U	2850	1.0	85.0	3L	1700	2.5		90.1	82.9	N			
													2	91.0	2U	1300	1.0										
													4	85.0	3U	2900	1.0										
41-16	HAW P28A3	C	Y	H	8.9	Y			14342	70	29.96	67	3	94.0	3L	2600	2.0							B	M	3L	2600	2.0
				H									2	95.0	3L	2600	2.0										
				H									4	92.0	3L	2600	2.0										
				L									3	86.0	3L	2600	2.0										
				L									2	86.0	3L	2600	2.0										
				L									4	85.0	3L	2600	2.0										

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

	VEHICLE DESCRIPTION								WEATHER				OCTANE NUMBER REQUIREMENT DATA								TANK FUEL INFORMATION							
						SPARK ADVANCE								MAXIMUM				PART THROTTLE						RATER			
OBS NO	MODEL CODE	EMCT	ENGSEN	C.R.	AIR	AS RCD	AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	OCT NO	GEAR	RPM	MV	OCT NO	GEAR	RPM	MV	OWKN	OCT NO RES	OCT NO MOT	NITR	GBAR	RPM	MV
29-14	HH3 P38A4	F	Y H	8.5	Y			16358	70	30.05	54	3	96.0	4U	1400	0.6	95.0	4U	1400	1.7	Y	91.9	82.6	A M	4U	1400	0.6
			H									2	97.0	4L	1400	0.6										
			H									4	93.0	4U	1400	0.6										
			L									3	96.0	4U	1400	0.6										
			L									2	96.0	2U	2200	0.5										
			L									4	90.0	4U	1600	0.6										
46-04	HHC P38A4	E	Y H	8.5	Y			8168	71	29.00	93	3	L				L				N	91.8	81.9	N			
			H									2	L														
			H									4	L														
			L									3	L				L										
			L									2	L														
			L									4	L														
47-03	HHC P38A4	F	Y H	8.5	Y			9350	70	30.08		3	82.0	3U	2000	0.8	F										
			H									2	84.0	3U	2500	0.8										
			H									4	80.0	4L	1500	0.5										
			L									3	80.0	3U	2500	0.8										
			L									2	82.0	3U	2500	0.8										
			L									4	78.0	4L	1600	0.5										
08-02	HJK T20A3	F	N	8.8	Y			8101	81	29.54	98	3	84.0	3L	1750	1.2	F							N			
												2	84.0	3L	1750	1.2										
												4	82.0	3L	1750	1.2										
65-16	HJK T20A3	F	N	8.8	Y	+ 8	+ 8	6370	75	29.44	76	3	93.0	3L	2300	0.5	92.0	3L	2250	4.5						
												2	95.0	3L	2300	0.5										
												4	91.0	3L	1850	1.0										
46-14	HJK T20A3	F	N	8.8	Y	+ 8	+ 8	6221	64	29.50	34	3	88.0	3L	2000	1.2	87.0	3L	1925	2.2	N	91.3	83.2	N			
												2	90.0	3U	3100	1.2										
												4	87.0	3L	2000	1.2										
28-18	HJK T20A3	F	N	8.8	Y	+ 8	+ 8	10749	70	29.15	50	3	92.0	2U	4000	1.0	93.0	3L	2100	4.0				B P	3L	2200	4.0
												2	94.0	2U	5000	1.3	95.0	3L	2100	4.0						
												4	91.0	3L	1400	1.5										
65-31	HJK T20M5	F	N	8.8	N	+ 8	+ 8	6313	51	29.40	35	3	92.0	2U	2800	0.0										
												2	92.5	4U	2200	0.0										
												4	91.5	4U	2800	0.0										
29-08	HNU T25A3	F	N	9.0	Y			18532	70	30.32	54	3	90.5	3L	1400	1.2	90.5	3L	1400	3.0	N						
												2	97.0	3L	1400	1.2										
												4	85.0	3U	2600	0.8										

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

	VEHICLE DESCRIPTION							WEATHER				OCTANE NUMBER REQUIREMENT DATA								TANK FUEL INFORMATION						
						SPARK ADVANCE						MAXIMUM				PART THROTTLE								RATER		
OBS NO	MODEL CODE	EMC T	KNK SEN	C.R.	AIR	AS RCD	AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	OCT NO	GEAR	RPM	MV	OCT NO	GEAR	RPM	MV	OWNK	OCT RES	OCT MOT	NIT	GTHR	GEAR	RPM	MV
65-07	HNU T25A3	F	N	9.0	Y			12800	83	29.43	100	3					90.5	3L	2400	3.8							
												2					94.0	3L	2450	4.0							
												4	86.0	3U	2800	0.5											
46-16	HNU T25M5	F	N	9.0	Y			15656	78	29.08	86	3	85.0	4	2000	1.0	81.0	4	2000	2.0	N	91.4	83.3	N				
												2	85.0	4	2400	1.0											
												4	85.0	4	2000	1.0											
08-08	HWW P28A4	F	Y	H	8.9	Y		6816	88	29.87	92	3	84.0	4L	1500	2.2	82.0	4L	1400	4.0				N			
				H								2	84.0	4L	1550	2.2	82.0	4L	1400	4.0							
				H								4	80.0	4L	1450	2.2	78.0	4L	1400	4.0							
				L								3	82.0	4L	1600	2.2											
				L								2	82.0	4L	1650	2.2											
				L								4	78.0	4L	1600	2.2											
08-19	HWW P28A4	F	Y	H	8.9	Y		6116	84	29.50	87	3	82.0	3L	1850	1.7	L							N			
				H								2	86.0	3L	1850	1.7											
				H								4	78.0	4L	1600	2.0											
				L								3	L														
				L								2	84.0	3L	1850	1.7											
				L								4	76.0	4L	1625	2.0											
29-02	HWW P28A4	F	Y	H	8.9	Y		10004	70	30.20	40	3	84.0	3L	1850	1.2	82.0	3L	1900	3.0	N						
				H								2	84.0	3L	1800	1.2											
				H								4	81.5	3L	1900	1.2											
				L								3	84.0	3L	1850	1.2											
				L								2	84.0	3L	1800	1.2											
				L								4	81.5	3L	1900	1.2											
29-19	HWW P28A4	F	Y	H	8.9	Y		8169	70	30.25	54	3	89.0	3U	2300	1.2	L				N						
				H								2	89.0	2U	2300	0.8											
				H								4	84.5	2U	2600	0.8											
				L								3	89.0	3U	2300	1.2											
				L								2	89.0	2U	2300	0.8											
				L								4	84.5	2U	2600	0.8											
65-02	HWW P28A4	F	Y	H	8.9	Y		8650	80	29.56	94	3	92.0	3U	2600	1.5											
				H								2	94.0	3U	2600	1.5											
				H								4	86.0	3U	2800	1.5											
				L								3	90.5	3U	2600	1.5											
				L								2	92.5	3U	2600	1.5											
				L								4	83.0	3U	2700	1.0											

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

VEHICLE DESCRIPTION									WEATHER				OCTANE NUMBER REQUIREMENT DATA								TANK FUEL INFORMATION							
						SPARK ADVANCE							MAXIMUM				PART THROTTLE							RATER				
OBS NO	MODEL CODE	EMCT	KNK SEN	C.R.	AIR	AS RCD	AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	OCT NO	GEAR	RPM	MV	OCT NO	GEAR	RPM	MV	OWKN	OCT NO RES	OCT NO MOT	NIT	GTHR	GEAR	RPM	MV
41-05	HWW P28A4	C	Y H	8.9	Y			11809	69	30.06	70	3	97.0	4L	1900	2.0								B	M	4L	1900	0.2
			H									2	98.0	4L	1900	2.0												
			H									4	93.0	4L	1900	2.0												
			L									3	86.0	4L	1900	2.0												
			L									2	86.0	4L	1900	2.0												
			L									4	85.0	4L	1900	2.0												
63-01	HYBJ 215A3	F	N	9.4	N	+ 5	+ 5	9198	70	29.38	50	3	92.0	3	1900	2.0	91.0	3	1900	6.0				B	M	3	2200	1.5
												2	93.0	3	1900	2.0	92.0	3	1900	6.0								
												4	92.0	3	2200	1.5												
07-09	HYBJ 215M5	F	N	9.4	N	+ 6	+ 6	9149	71	30.34	51	3	88.0	3	1700	0.7	86.0	4	2600	7.5	N	92.2	82.2	N				
												2	88.0	3	2200	1.1												
												4	87.0	4	2700	0.7												
65-10	HYBJ 215M5	F	N	9.4	N	+ 4	+ 4	14600	83	29.45	113	3					95.0	4	1800	7.0								
												2					95.5	4	1800	9.0								
												4					93.0	4	1800	8.0								
41-12	HYBJ 215M5	C	N	9.4	N	+ 5	+ 5	23065	70	29.90	68	3	87.0	4	3200	1.0	86.0	4	3200	2.0	N	91.8	83.3	N				
												2	87.0	4	3200	1.0												
												4	86.0	4	3200	1.0												
06-12	HYBJ 215M5	F	N	9.4	Y	- 5	- 5	14990	67	30.02	62	3	96.0	3	1200	1.4	101.0	3	1200	8.0	Y	93.2	83.3	A	P	3	1200	7.0
												2	95.0	3	1200	1.4	102.0	3	1200	9.0								
												4	97.0	3	1200	1.4												
23-12	IA3 P38A4	F	Y H	8.5	Y			9607	52	29.30	28	3	91.0	3L	1900	1.2	90.0	4L	1500	2.0	N			N				
			H									2	91.0	3L	1700	1.2												
			H									4	90.0	4L	1500	1.2												
			L									3	84.0	3L	1700	1.2												
			L									2	84.0	3L	1700	1.2												
			L									4	82.0	4L	1600	1.2												
08-15	IAR T25A3	F	N	8.3	Y			17704	95	29.59	131	3	87.0	3L	2050	1.0	84.0	3L	1550	4.0				N				
												2	91.0	3L	1950	1.0												
												4	84.0	3L	1850	1.0												
23-01	IAR T25A3	B	N	8.3	Y			12010	78	29.23	52	3	92.0	2U	2800	0.8	98.0	3L	2700	4.5				A	P	3L	2400	4.5
												2	94.0	2U	2900	0.8	101.0	3L	2800	4.5								
												4	88.0	2U	2700	0.8												
23-28	IAR T25A3	F	N	8.3	Y			16145	32	28.95	16	3	91.0	3U	2800	0.8	94.0	3U	2900	4.0	N			A	P	3U	2850	5.1
												2	93.0	3U	2900	0.8	97.0	3U	2500	4.0								
												4	86.0	3U	2800	0.8												

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMCT	ENGINE SEN	C.R.	AIR	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OWNER KEN	TANK FUEL INFORMATION OCT NO RES	TANK FUEL INFORMATION OCT NO MOT	RATER KENT	RATER GEAR	RATER RPM	RATER MV
23-29	IAR T25A3	F	N	8.3	Y			6473	36	29.09	20	3	89.0	3U	2700	1.6	93.0	3U	2900	5.0	N			S	P	3U	3600	5.0
												2	91.0	3U	2500	1.6	96.0	3U	2900	5.0							
												4	85.0	3U	2700	1.6											
60-01	IAR T25A3	E	N	8.3	Y			8.56	78	29.50		3	89.0	2L	1900	1.2	89.5	3U		2.5							
												2	91.0	3L	1450	2.2	92.0	3U		2.5							
												4	85.0	3L	1750	2.0											
38-05	IAW P28A3	F	Y	H	8.9	Y		13144	73	29.43	44	3	88.0	3U	2450	2.2	86.0	3L	2300	4.0				N			
				H								2	91.0	3U	2450	2.2											
				H								4	82.0	3U	2450	2.2											
				L								3	86.0	3U	2500	2.2											
				L								2	89.0	3U	2500	2.2											
				L								4	91.0	3U	2500	2.2											
23-30	IAW P28A3	F	Y	H	8.9	Y		12159	38	29.03	16	3	82.0	3U	2900	1.5	80.0	3L	2000	3.0	N			N			
				H								2	85.0	3U	2800	1.5											
				H								4	83.9	3U	3000	1.5											
				L								3	82.0	3U	2900	1.5											
				L								2	85.0	3U	2800	1.5											
				L								4	82.0	3U	3000	1.5											
08-04	ICC P38A4	F	Y	H	8.5	Y		8516	72	29.62	54	3	80.0	3L	1600	1.0	L							N			
				H								2	84.0	3U	2100	1.0											
				H								4	78.0	4L	1250	1.2											
				L								3	L														
				L								2	L														
				L								4	76.0	4L	1400	1.2											
47-13	ICC P38A4	C	Y	H	8.5	Y		12250	70	29.98	50	3	82.0	3L	1700	0.5											
				H								2	83.0	3L	1900	0.5											
				H								4	80.0	4L	1400	0.8											
				L								3	81.0	3L	1700	0.5											
				L								2	82.0	3L	1900	0.5											
				L								4	79.0	4L	1400	0.8											
47-10	ICC P38A4	C	Y	H	8.5	Y		14435	70	29.80	62	3	80.0	4L	1500	1.0											
				H								2	82.0	4L	1600	1.0											
				H								4	78.0	4L	1500	1.0											
				L								3	L														
				L								2	80.0	4L	1500	1.0											
				L								4	76.0	4L	1500	1.0											

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EM CT	KNK SEN	C.R.	SPARK ADVANCE AIR	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	TANK FUEL INFORMATION OWNK	RATER OCT NO RES	RATER OCT NO MOT	RATER KNIT	RATER THR	RATER GEAR	RATER RPM	RATER MV
08-13	IGV 450A4	F	Y H	8.0	Y	+20	+20	10555	87	29.77	94	3	85.0	2U	2150	0.5	84.0	4L	1300	7.0				N				
			H									2	86.0	2U	2550	0.5	85.0	4L	1350	7.0								
			H									4	83.0	2U	2000	0.5												
			L									3	84.0	2U	2100	0.5												
			L									2	85.0	2U	2500	0.5												
			L									4	82.0	2U	2000	0.5												
23-09	IH3 P38A4	F	Y H	8.5	Y			10487	58	29.12	52	3	84.0	3U	2000	1.2	82.0	3U	2000	2.0	N			N				
			H									2	85.0	3U	2000	1.2												
			H									4	83.0	3U	2000	1.2												
			L									3	L															
			L									2	82.0	3U	2000	1.2												
			L									4	L															
29-07	IHC P38A4	F	Y H	8.5	Y			10889	70	30.32	54	3	85.5	2U	1750	0.6	L											
			H									2	85.5	2U	2100	0.6												
			H									4	82.0	2U	1900	0.6												
			L									3	85.5	2U	1750	0.6												
			L									2	85.5	2U	2100	0.6												
			L									4	82.0	2U	1900	0.6												
07-14	IHC P38A4	F	Y H	8.5	Y			12809	69	30.06	42	3	84.0	3L	1900	1.5	80.0	4L	1100	4.0	N	92.2	82.2	B	M	3L	2600	1.5
			H									2	86.0	4L	1150	1.2												
			H									4	84.0	3L	2000	1.5												
			L									3	83.0	4L	1300	1.2												
			L									2	85.0	4L	1300	1.2												
			L									4	83.0	4L	1100	1.2												
65-01	IHC P38A4	F	Y H	8.5	Y			12150	80	29.45	94	3	86.0	3U	2300	0.0												
			H									2	87.0	3U	2125	0.0												
			H									4	82.0	2U	2300	0.0												
			L									3	81.0	2U	2000	0.0												
			L									2																
			L									4	81.0	2U	2400	0.0												
06-14	IHC P38A4	F	Y H	8.5	Y			7390	59	30.23	43	3	93.0	3U	2300	1.0	94.0	3U	2300	2.0	N	99.4	86.6	N				
			H									2	94.0	3L	1800	1.2	97.0	3U	2300	2.0								
			H									4	88.0	4U	1600	1.0												
			L									3	89.0	3U	2300	1.0	90.0	3U	2300	2.0								
			L									2	90.0	3L	2400	1.2	93.0	3U	2300	2.0								
			L									4	85.0	4U	1400	1.0												

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMCT	KNK SEN	AIR C.R.	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OWNER	OCT NO RES	OCT NO MOT	INTR	RATER GEAR	RATER RPM	RATER MV
07-06	IND P23A3	F	Y H	9.5	Y		12517	74	29.71	46	3	80.0	3L	1750	0.7	80.0	3L	1700	4.0	N	99.8	88.2	N			
			H								2	80.0	3L	1800	0.7											
			H								4	77.0	3U	2700	1.1											
			L								3															
			L								2															
			L								4															
65-09	IND P23A3	F	Y H	9.5	Y		20300	80	29.75	78	3	89.0	3L	1800	1.0											
			H								2	90.0	3U	2100	0.5											
			H								4	89.0	3L	1800	1.0											
			L								3	86.5	3L	1600	1.5											
			L								2	88.5	3L	1600	1.5											
			L								4	86.5	3L	1600	1.0											
28-24	IND P23A3	F	Y H	9.5	Y		10672	70	29.13	50	3	85.0	3L	1400	2.3	86.0	3L	1400	8.0				N			
			H								2	85.0	3L	1500	2.3	88.0	3L	1400	8.0							
			H								4	84.0	3L	1450	2.3											
			L								3					85.0	3L	1500	8.0							
			L								2	85.0	3L	1500	2.3	85.0	3L	1400	8.0							
			L								4	84.0	3L	1450	2.3											
28-19	IND P23A3	F	Y H	9.5	Y		11143	70	29.04	50	3	82.0	3L	1500	1.0	81.0	3L	1450	10.0				N			
			H								2	85.0	2U	2900	0.5	84.0	3U	1900	11.0							
			H								4	83.0	2U	2900	0.5											
			L								3	L														
			L								2	L														
			L								4	79.0	2L	2800	0.5											
26-02	IND P23A3	E	Y H	9.5	Y		8046	78	30.32	36	3	86.0	2U	950	0.5								N			
			H								2	87.0	3U	1025	0.5											
			H								4	85.0	2U	975	0.5											
			L								3	84.0	2U	975	0.5											
			L								2	85.0	3U	1025	0.5											
			L								4	83.0	2U	975	0.5											
41-15	INU T25A3	C	N	9.0	Y		18640	70	29.97	68	3	85.0	3L	2000	1.5	83.0	3L	2000	2.5				N			
											2	86.0	3L	2000	1.5											
											4	84.0	3L	2000	1.5											

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

	VEHICLE DESCRIPTION								WEATHER				OCTANE NUMBER REQUIREMENT DATA								TANK FUEL INFORMATION							
						SPARK ADVANCE							MAXIMUM				PART THROTTLE							RATER			
OBS NO	MODEL CODE	EMCT	KNK SEN	C.R.	AIR	AS RCD	AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	OCT NO	GEAR	RPM	MV	OCT NO	GEAR	RPM	MV	OWKN	OCT NO RES	OCT NO MOT	NITN	GTHR	GBAR	RPM	MV
08-12	IWW P23A4	F	Y H	8.9	Y			6726	73	29.85	103	3	99.0	3L	1750	2.0	96.0	4L	1750	6.0				N			
			H									2	90.0	3L	1700	2.0											
			H									4	86.0	3L	1650	2.0											
			L									3	86.0	3L	1800	2.0											
			L									2	87.0	3L	1700	2.0											
			L									4	84.0	3L	1700	2.0											
65-18	IZA7 215A3	F	N	9.6	N	+ 3	+ 3	6450	65	29.20	68	3	86.5	2	1200	8.0	86.5	2	1200	8.0							
												2	89.0	2	1200	8.0	89.0	2	1200	8.0							
												4	82.5	2	2600	1.5											
05-08	JB3 T15M5	F	N	9.2	Y	+17	+17	17286	70	30.10	28	3	90.0	4	2300	1.0	F				N	97.5	88.7	N			
												2	92.0	3	3050	1.2											
												4	88.0	4	2150	1.0											
41-17	JB6 T15M4	C	N	9.2	Y	+18	+18	21709	69	30.10	67	3	88.0	4	1800	1.0	86.0	4	1800	2.0				N			
												2	89.0	4	1800	1.0											
												4	86.0	4	1800	1.0											
41-01	JC5 220A4	C	N	9.1	Y	+19	+15	10955	70	30.00	70	3	83.0	3U	2800	2.0	F				N	91.6	83.6				
												2	84.0	3U	2800	2.0											
												4	81.0	3U	2800	2.0											
06-04	JC5 220M5	F	N	9.1	Y	+24	+24	10014	69	29.89	46	3	91.0	4U	1500	1.8	89.0	3U	1300	3.0	N	94.6	84.5	B	M	4U	2000	1.4
												2	92.0	4U	2200	1.9											
												4	90.0	4U	2000	1.8											
65-30	JC5 P20A4	F	N	9.3	Y	+15	+15	11600	47	29.44	38	3	89.0	4U	3100	0.0	87.5	4U	3100	1.5							
												2	90.5	4U	3100	0.0											
												4	87.0	4U	3100	0.0											
47-17	JC5 P20M5	C	N	9.3	Y	+15	+15	19000	70	29.90	50	3	89.0	4	2350	0.0	87.0	4	3000	1.0							
												2	89.0	4	2350	0.0											
												4	89.0	4	2350	0.0											
05-25	JC5 P20M5	F	N	9.3	Y	+15	+15	10412	70	30.07	50	3	94.0	4	2900	0.8	F				Y	97.5	86.7	N			
												2	96.0	4	2950	0.8											
												4	91.0	4	2750	0.8											
46-01	JC5 P20M5	F	N	9.3	Y	+15	+15	7248	66	29.20	82	3	89.0	4	1650	1.0	86.0	4	2000	2.0	N	91.2	82.8	N			
												2	89.0	4	1900	1.0											
												4	90.0	4	2375	1.0											
28-05	JD4 P20A4	F	N	9.0	Y	+15	+15	9774	70	29.41	50	3	86.0	2U	2400	0.5	F							N			
												2	87.0	2U	2400	0.5											
												4	84.0	2U	2400	0.5											

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	BMC T	KNK SEN	C.R.	SPARK ADVANCE AIR	SPARK ADVANCE RCD	SPARK ADVANCE TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	TANK FUEL INFORMATION: OWNK	RATER: OCT NO RES	RATER: OCT NO MOT	RATER: KNIT	RATER: GEAR	RATER: RPM	RATER: MV
40-03	KC3 P30A3	F	N	8.9	Y			9130	55	30.21	27	3	83.0	2	3500	0.0	F							N			
												2	86.0	2	3800	0.0											
												4	82.5	2	3500	0.0											
28-14	KC2 P30A3	F	N	8.9	Y	+12	+12	11126	70	29.22	50	3	82.0	2	2300	0.5	81.0	2	2100	1.5				N			
												2	83.0	2	2100	0.5											
												4	81.0	2	2000	0.5											
23-06	KCK T25A3	F	N	9.0	Y	+12	+12	9517	70	29.39	50	3	L				L							N			
												2	81.0	2U	3500	0.5											
												4	79.0	3L	1700	1.5											
60-07	KGETP22A3	F	Y	H	8.1	Y	+12	+12	8554	74	29.60		3	80.0	3	2200	-7.0	80.0	2	2600	-5.0				B	M	3	2400	-8.0
				H								2	81.0	3	2500	-8.0	L										
				H								4	L				L										
				L								3	L				80.0	2	2600	-5.0							
				L								2	80.0	3	2500	-8.0											
				L								4	L				L										
05-28	KHETP22A3	F	Y	H	8.1	Y	+10	+10	6050	70	29.50	34	3	88.0	3	3050	-7.0	87.0	3	2750	-1.0	N	96.4	87.8	N			
				H								2	88.0	3	2900	-7.0	87.0	3	2800	-1.0							
				H								4	88.0	3	2900	-7.0											
				L								3	86.0	3	2900	-7.0											
				L								2	85.0	3	2900	-7.0											
				L								4	87.0	3	3000	-7.0											
65-19	KHK T25A3	F	N	9.0	Y	+12	+12	6000	69	29.12	72	3					86.0	3U	2200	1.5							
												2					86.0	3U	2200	2.0							
												4	86.0	3U	2800	0.0											
65-04	KLC T22A3	F	N	9.5	N	+12	+12	9850	88	29.51	104	3	87.5	3U	2200	0.5	87.5	3L	2500	3.0							
												2	89.0	3U	2500	1.0	89.0	3L	2500	3.0							
												4	86.5	3U	2400	1.0											
06-27	KLC T22A3	F	N	9.5	Y	+ 7	+12	6581	37	30.00	24	3	92.0	3L	2600	0.4	91.0	3L	2200	1.4	N	92.7	82.3	B	M	3U	2800	0.4
												2	93.0	3U	2900	0.4											
												4	92.0	3U	2800	0.4											
08-06	KPD T22A3	A	N	9.5	Y	+12	+12	8029	90	30.00	101	3	86.0	3	1950	1.0	F							N			
												2	87.0	3	1950	1.0											
												4	84.0	3	2050	1.0											
29-12	KPD T22A3	F	N	9.5	Y	+12	+12	14047	70	30.30	54	3	88.0	2	1950	0.8	85.5	3	1950	2.2	N						
												2	87.5	2	2450	0.8											
												4	87.0	2	2000	0.8											

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMCT	EMK SEN	SPARK ADVANCE AIR C.R.	SPARK ADVANCE AIR ASRCD	SPARK ADVANCE AIR ASTST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	RATER WEKN	RATER OCT NO RES	RATER OCT NO MOT	RATER NITR	RATER GTHR	RATER GEAR	RATER RPM	RATER MV
65-29	KPK T25A2	F	N	9.0	Y		10600	49	29.63	36	3	85.0	3L	2300	0.5	85.5	3L	2300	2.0								
											2	86.0	3L	2300	0.5	86.0	3L	2300	2.0								
											4	85.0	3L	2300	0.5	85.0	3L	2300	2.0								
08-03	KICK 215A3	F	N	9.4	Y	+ 5	+ 5	6501	73	29.50	36	3	86.0	3	2450	2.2	84.0	3	2000	5.0				N				
											2	87.0	3	2500	2.2												
											4	84.0	3	2100	2.2												
63-02	KICK 215A3	F	N	9.4	Y	+ 5	+ 5	6002	70	28.87	50	3	89.0	2	2300	0.5	86.0	3	2000	1.5				N				
											2	90.0	3	2300	0.5												
											4	87.0	3	2200	0.5												
05-18	KICK 215M5	F	N	9.4	Y	+ 5	+ 5	14493	70	29.98	50	3	87.0	4	1800	1.8	86.0	4	1950	3.0	N	92.5	82.0	N				
											2	88.0	4	1250	1.8												
											4	86.5	4	1850	1.8												
25-03	KIENTT26M5	F	Y	H	7.0	Y	+11	+11	11172	70	29.35	60	3	84.0	4	1400	-1.0	80.0	4	1400	0.0				N				
				H								2	86.0	4	2700	-9.0												
				H								4	83.0	4	1500	-2.0												
				L								3	L				L											
				L								2	L															
				L								4	79.0	4	1600	-2.0												
29-07	LA3 P38A4	F	Y	H	8.5	Y			10369	70	29.23	50	3					90.0	2U	2800	2.0				B	M	4U	1300	0.5
				H								2					92.0	2U	2900	2.0								
				H								4	88.0	4U	1400	0.5												
				L								3					87.0	2U	2900	2.0								
				L								2					89.0	2U	2800	2.0								
				L								4	84.0	4U	1400	0.5												
46-17	LA3 P38A4	F	Y	H	8.5	Y			8181	80	29.61	94	3	L				L				N	97.3	86.3					
				H								2	L															
				H								4	L															
				L								3	L				L											
				L								2	L															
				L								4	L															
29-26	LAR T25A3	F	N	8.3	Y			19751	70	30.08	50	3	88.5	3U	2000	0.8	88.0	3U	1900	3.0				N				
											2	90.5	2U	3000	0.6												
											4	86.0	2U	2500	0.6												
23-17	LAR T25A3	F	N	8.3	Y			16344	70	30.20	50	3					93.5	2U	2000	3.0	Y	92.0	82.5	A	P	3U	1900	3.0
											2					95.5	2U	2100	3.0								
											4	85.0	2U	2400	0.7												

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

	VEHICLE DESCRIPTION							WEATHER				OCTANE NUMBER REQUIREMENT DATA								TANK FUEL INFORMATION							
						SPARK ADVANCE							MAXIMUM				PART THROTTLE							RATER			
OBS NO	MODEL CODE	EMC T	KNK SEN	A/I	C.R.	AS RCD	AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	OCT NO	GEAR	RPM	MV	OCT NO	GEAR	RPM	MV	OWN	OCT NO RES	OCT NO MOT	NIT	THR	GEAR	RPM	MV
29-03	LAR T25A3	F	N	Y	8.3			19995	70	30.20	40	3	93.5	2U	3300	0.6	93.0	3U	2400	2.5	Y	93.2	83.6	B	M	2U	2800	0.6
												2					96.5	3U	2200	4.0							
												4	87.5	2U	3100	0.6											
29-04	LAW P28A3	F	Y H	Y	8.9			17950	70	30.20	40	3	88.5	2U	2700	0.8	87.0	3U	2200	4.0	N			N				
			H									2	90.5	3U	2200	0.8											
			H									4	85.5	2U	2500	0.8											
			L									3	87.5	2U	2700	0.8											
			L									2	90.5	3U	2200	0.8											
			L									4	85.5	2U	2500	0.8											
29-16	LAW P28A3	F	Y H	Y	8.9			19478	70	30.20	54	3	92.5	2U	2600	1.0	L							N				
			H									2	95.0	2U	2600	1.0											
			H									4	87.5	2U	2600	1.0											
			L									3	92.5	2U	2600	1.0											
			L									2	95.0	2U	2600	1.0											
			L									4	87.5	2U	2600	1.0											
29-28	LAW P28A3	F	Y H	Y	8.9			20215	70	30.10	50	3	98.5	2U	1850	0.8	85.5	3U	1950	3.0				N				
			H									2	90.5	2U	2300	0.8											
			H									4	86.5	2U	2000	0.8											
			L									3	88.5	2U	1850	0.8											
			L									2	90.5	2U	2300	0.8											
			L									4	86.5	2U	2000	0.8											
23-27	LAW P28A4	F	Y H	Y	8.9			7432	41	28.96	18	3	85.0	3L	1900	1.4	84.0	4L	1600	3.0	N			N				
			H									2	86.0	3L	1900	1.4											
			H									4	84.0	3L	1900	1.4											
			L									3	82.0	3L	1900	1.4											
			L									2	84.0	3L	1900	1.4											
			L									4	L														
05-27	LAW P28A4	F	Y H	Y	8.9			8646	68	29.60	22	3	94.0	2U	3000	1.2	F											
			H									2	96.0	2U	2850	1.2	90.0	3U	2750	3.5								
			H									4	92.0	2U	2750	1.2	F											
			L									3	99.0	2U	2900	1.2											
			L									2	91.0	2U	3000	1.2											
			L									4	87.0	2U	2900	1.2											

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

	VEHICLE DESCRIPTION						WEATHER				OCTANE NUMBER REQUIREMENT DATA								TANK FUEL INFORMATION						
												MAXIMUM				PART THROTTLE						RATER			
OBS NO	MODEL CODE	EMIS CNT	ENK SEN	C.R.	SPARK ADVANCE AIR	AS RCD	AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	OCT NO	GEAR	RPM	MV	OCT NO	GEAR	RPM	MV	OWNK	OCT NO RES	OCT NO MOT	INIT	TH	GEAR	RPM	MV
23-02	LCC P38A4	F	Y H	8.5	Y			16171	58	29.15	36	3	82.0	2U	2400	0.6	L				N			N			
			H									2	82.0	2U	2400	0.6											
			H									4	82.0	2U	2300	0.6											
			L									3	L														
			L									2	82.0	2U	2400	0.6											
			L									4	L														
23-04	LCC P38A4	F	Y H	8.5	Y			16064	68	29.11	80	3	82.0	3U			L				N			N			
			H									2	82.0	3U	2400	0.8											
			H									4	80.0	3U													
			L									3	L														
			L									2	L														
			L									4	L														
05-02	LH3 P38A4	F	Y H	8.5	Y			7211	70	30.10	52	3	87.0	2U	2000	1.2					N	92.2	82.6	N			
			H									2	89.0	2U	1950	1.2											
			H									4	84.0	2U	2000	1.2											
			L									3	86.0	2U	1950	1.2											
			L									2	88.0	2U	1925	1.2											
			L									4	84.0	2U	2000	1.2											
28-03	LHC P38A4	F	Y H	8.5	Y			9642	70	.	50	3	81.0	2U	2050	0.5	L							N			
			H									2	84.0	2U	2000	0.5											
			H									4	81.0	2U	2000	0.5											
			L									3	L														
			L									2	82.0	2U	2000	0.5											
			L									4	81.0	2U	2000	0.5											
28-[illegible]	LHC P38A4	F	Y H	8.5	Y			10727	70	29.24	50	3	L				L							N			
			H									2	L				L										
			H									4	79.0	2U	2100	0.5											
			L									3	L				L										
			L									2	L				L										
			L									4	79.0	2U	2100	0.5											
26-01	LHC P38A4	F	Y H	8.5	Y			10260	70	30.10	53	3	80.0	2U	1700	0.5	L							N			
			H									2	80.0	2U	2000	0.5	L										
			H									4	78.0	2U	1650	0.5											
			L									3	L														
			L									2	L														
			L									4	77.0	2U	1500	0.5											

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMI TST	ENG SEN	C.R.	SPARK ADVANCE AIR	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	GWEN	RATER OCT NO RES	RATER OCT NO MOT	INT TR	GEAR	RATER RPM	RATER MV
26-07	LHC P38A4	E	Y H	8.5	Y			10182	78	30.40	24	3	80.0	4L	1400	0.3	L							N			
			H									2	82.0	4L	1400	0.3											
			H									4	76.0	4L	1500	0.3											
			L									3	L														
			L									2	81.0	4L	1450	0.3											
			L									4	L														
05-03	LJE T20A3	F	N	8.8	Y	+ 8	+ 8	9774	70	30.28	50	3	93.0	2U	2950	1.6					N	97.9	87.6	N			
												2	96.0	2U	2900	1.6											
												4	88.0	2U	1900	1.6											
29-09	LJE T20A3	F	N	8.8	Y	+ 8	+ 8	18672	70	30.32	40	3	91.5	3L	1800	0.6	89.5	3L	1700	3.2				N			
												2					94.0	3U	2400	4.5							
												4	90.0	3L	1900	0.6											
06-01	LJE T20A3	F	N	8.8	Y	- 8	- 8	18204	66	29.72	63	3	90.0	3L	2300	1.0					Y	93.3	82.4	B	P	3L	1900	5.0
												2	92.0	2U	3100	0.8	95.0	3L	2000	5.0							
												4	88.0	3L	2100	1.0											
47-13	LWW P28A4	C	Y H	8.9	Y			21500	70	30.08	50	3	95.0	4L	1800	1.2	91.0	4L	1800	2.2							
			H									2	97.0	4L	1800	1.2											
			H									4	90.0	4L	1700	1.2											
			L									3	90.0	4L	1800	1.2											
			L									2	93.0	4L	1800	1.2											
			L									4	88.0	4L	1700	1.2											
05-07	LWW P28A4	F	Y H	8.9	Y			6074	70	30.09	50	3	85.0	2U	2700	1.5					N	92.0	82.0	N			
			H									2	86.0	2U	2700	1.5											
			H									4	84.0	2U	2900	1.5											
			L									3	85.0	2U	2700	1.5											
			L									2	85.0	2U	2700	1.5											
			L									4	84.0	2U	2900	1.5											
46-05	LWW P28A4	F	Y H	8.9	Y			10873	98	29.15	75	3	L				L				N	91.0	83.0	N			
			H									2	L														
			H									4	L														
			L									3	L				L										
			L									2	L														
			L									4	L														

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

	VEHICLE DESCRIPTION								WEATHER				OCTANE NUMBER REQUIREMENT DATA								TANK FUEL INFORMATION						
														MAXIMUM				PART THROTTLE						RATER			
OBS NO	MODEL CODE	EMCT	SEN	KNK C.R.	SPARK ADVANCE AIR	SPARK ADVANCE RCD	SPARK ADVANCE TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	OCT NO	GEAR	RPM	MV	OCT NO	GEAR	RPM	MV	OWNK	OCT NO RES	OCT NO MOT	INITR	THRR	GEAR RPM	MV
28-15	LWW P28A4	F	Y	H 8.9				10678	70	29.20	50	3	81.0	2U	2500	0.5	L							N			
				H								2	84.0	2U	2800	0.5											
				H								4	81.0	2U	2800	0.5											
				L								3	81.0	2U	2500	0.5											
				L								2	83.0	2U	2800	0.5											
				L								4	80.0	2U	2900	0.5											
06-10	LWW P28A4	F	Y	H 8.9	Y			21423	75	29.67	97	3	92.0	4L	1600	2.5	92.0	4L	1600	3.5							
				H								2	95.0	3U	3000	1.5											
				H								4	85.0	4L	1700	2.3											
				L								3	88.0	4L	1600	2.5											
				L								2	93.0	3U	3200	1.2											
				L								4	84.0	4L	1400	3.0											
24-02	LWW P28A4	F	Y	H 8.9	Y			16500	68	29.60	78	3	82.0	3U	2000	3.5	L				N	93.4	84.2	N			
				H								2	85.0	3U	2000	3.5											
				H								4	81.0	3U	2000	3.5											
				L								3	82.0	3U	2000	3.5	L										
				L								2	85.0	3U	2000	3.5											
				L								4	81.0	3U	2000	3.5											
32-03	MC5 P16A3	B	N	9.3	Y	+ 2	+ 2	7146	84	29.47	62	3	82.0	3	3500	0.6	80.0	3	2900	2.0	N	91.6	82.3	N			
												2	82.0	2	3000	0.5	82.0	2	3100	2.0							
												4	80.0	3	2800	0.6											
32-30	MC5 P16A3	F	N	9.3	Y	+ 1	+ 1	13987	86	29.32	65	3	87.0	3	2800	0.3	87.0	2	2800	2.0	N	91.5	82.4	N			
												2	88.0	2	2900	0.5	86.0	3	3400	3.0							
												4	87.0	3	2800	0.3	87.0	2	2800	2.0							
29-29	MC5 P16A3	F	N	9.3	Y	+ 2	+ 2	19388	70	30.10	54	3	85.5	2	2250	0.5	82.0	2	2550	2.0	N			N			
												2	86.5	3	2450	0.8											
												4	87.5	2	2300	0.5											
05-12	MC5 P16A3	F	N	9.3	Y	+ 2	+ 2	10684	70	30.20	28	3	90.0	3	3400	1.5	F										
												2	91.0	3	3000	1.5											
												4	89.0	3	3300	1.5											
07-02	MC5 P16A3	F	N	9.3	Y	+ 2	+ 2	14510	65	30.39	41	3	90.0	3	3000	0.7	F				N	94.2	83.7	N			
												2	90.0	3	3100	0.7											
												4	88.0	3	3100	0.7											
07-03	MC5 P16A3	F	N	9.3	Y	+ 2	+ 2	23733	72	30.39	50	3	91.0	3	3000	0.6	F				N	97.6	85.9	N			
												2	93.0	3	3100	0.6											
												4	90.0	3	3000	0.6											

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMCT	ENK SBN	SPARK ADVANCE AIR	C.R.	AS RCD	AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OWNER	RATER OCT NO RBS	RATER OCT NO MOT	RATER INIT	RATER THR	RATER GEAR	RATER RPM	RATER MV
28-22	MC5 P16A3	F	N	Y	9.3	+ 2	+ 2	10931	70	29.40	50	3	89.0	2	2300	0.5	85.0	3	2250	1.5				N				
												2	90.5	3	2800	0.5												
												4	89.0	2	2300	0.5												
41-07	MC5 P16A3	C	N	Y	9.3	+ 2	+ 2	22296	70	.	70	3	86.0	3	2800	1.0	84.0	3	2800	2.0	N			N				
												2	87.0	3	2800	1.0												
												4	84.0	3	2800	1.0												
65-27	MC5 P16A3	F	N	N	9.3	+ 2	+ 2	6000	45	29.88	35	3	85.0	3	3400	0.0	81.0	3	3200	1.0								
												2	86.0	3	3500	0.0												
												4	83.0	3	3200	0.0												
29-22	MC5 P16A3	F	N	Y	9.3	+ 2	+ 2	14109	70	30.10	50	3	81.0	3	3200	0.5	80.0	3	3400	2.0	N			N				
												2	84.0	3	3300	0.5												
												4	81.5	3	3000	0.5												
29-11	MC5 P16A3	F	N	Y	9.3	+ 2	+ 2	12750	70	30.30	50	3	81.0	3	2800	0.6	L											
												2	83.0	3	2800	0.6												
												4	80.5	3	3000	0.6												
05-30	MDU P30A4	F	Y	H	9.3	Y	+10	+10	9009	70	30.40	34	3	90.0	3U	1100	3.0	88.0	3U	1050	8.0								
				H								2	91.0	3U	1700	3.0	91.0	3U	1150	8.0								
				H								4	90.0	3U	1300	3.0												
				L								3	89.0	2U	1900	2.0												
				L								2	90.0	2U	2100	2.0												
				L								4	88.0	2U	1850	2.0												
46-02	MDU P30A4	F	Y	H	9.3	Y	+ 9	+ 9	16221	95	29.42	75	3	92.0	3U	2300	1.0	91.0	4L	1450	2.0	N	91.8	82.4					
				H								2	95.0	3U	1325	1.0												
				H								4	88.0	3U	2625	1.0												
				L								3	91.0	3U	1950	1.0	91.0	4U	1450	2.0								
				L								2	94.0	3U	1525	1.0												
				L								4	88.0	3U	2625	1.0												
40-04	MDU P30A4	F	Y	H	9.3	Y	+10	+10	12415	59	30.22	19	3	93.0	2U	3200	0.0	F							B	M	2U	4100	0.0
				H								2	94.0	2U	4000	0.0												
				H								4	90.5	2U	4000	0.0												
				L								3																	
				L								2																	
				L								4																	

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMCT	ENGSEN	SPARK ADVANCE AIR C.R.	SPARK ADVANCE AIR RCD	SPARK ADVANCE AIR TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OWNK	RATER OCT NO RES	RATER OCT NO MOT	RATER INTR	RATER GEAR	RATER RPM	RATER MV
06-26	MDU P30A4	F	Y H	9.3	Y	+10	+10	8252	50	29.96	23	3	93.0	4U	1500	0.4	93.0	4U	1650	3.5	N	92.7	82.2	A	M	2U	3800	0.4
			H									2	95.0	2U	3800	0.4												
			H									4	93.0	4U	1500	0.4												
			L									3	92.0	4U	1600	0.4												
			L									2	93.0	2U	3800	0.4												
			L									4	92.0	4U	1500	0.4												
32-17	MPF P50A4	F	N	8.9	Y	+11	+10	8503	87	28.90	67	3	88.0	4	950	1.0	88.0	4	950	2.0	N	93.0	83.0	N				
												2	89.0	4	950	1.0	89.0	4	950	2.0								
												4	88.0	4	950	1.0	88.0	4	950	2.0								
32-21	MPF P50A4	F	N	8.9	Y	+ 8	+10	9931	85	29.30	65	3	91.0	4	1000	1.0	91.0	4	1000	7.0	M			B	M	4	1000	1.0
												2	91.0	4	1000	1.0	91.0	4	1000	7.0								
												4	90.0	4	950	1.0	90.0	4	950	7.0								
32-27	MPF P50A4	F	N	8.9	Y	+ 9	+10	14288	85	29.28	60	3	90.0	4	950	1.2	91.0	4	900	4.0	N	98.1	87.3	N				
												2	91.0	4	900	1.2	92.0	4	950	4.0								
												4	90.0	4	900	1.2	90.0	4	900	4.0								
32-10	MS4 P38A4	F	N	9.0	Y	+10	+10	7668	85	29.44	67	3	90.0	3	2700	0.5	90.0	2	3400	3.0	N	92.3	83.0	B	M	3L	2600	0.5
												2	91.0	3	2800	0.5	91.0	2	3400	3.0								
												4	90.0	2	3100	0.7	90.0	2	3400	3.0								
32-22	MS4 P38A4	F	N	9.0	Y	+10	+10	61990	85	29.31	64	3	93.0	3	2600	0.3	92.0	3	3000	3.0	N	91.1	82.2	B	M	2L	2500	0.4
												2	94.0	3	3000	0.3	92.0	3	3000	3.0								
												4	92.0	3	2900	0.3	92.0	3	3050	3.0								
40-02	MS4 P38A4	F	N	9.0	Y	+10	+10	10307	77	29.82	36	3	94.5	3	3000	0.0	F							A	M	3	2300	0.5
												2	95.5	3	2800	0.0												
												4	91.5	3	2900	0.0												
32-07	MTS P23A3	F	N	9.0	Y	+15	+15	11218	85	29.65	64	3	89.0	3	2400	0.7	89.0	3	2200	3.0	N	92.5	84.0	N				
												2	90.0	3	2200	0.7	90.0	3	2300	3.0								
												4	88.0	3	2550	0.7	88.0	3	2400	3.0								
08-11	MTX P23A3	F	N	9.0	Y	+15	+15	10643	86	29.84	107	3	86.0	3	2250	1.0	84.0	3	2000	3.0				N				
												2	89.0	3	2350	1.0												
												4	85.0	3	2350	1.0												
08-16	MTX P23A3	F	N	9.0	Y	+15	+15	8507	83	29.61		3	80.0	3	2700	1.0	L							N				
												2	81.0	3	2700	1.0												
												4	80.0	2	2950	0.5												
32-23	MKAV P29A4	F	N	9.0	Y	+10	+10	5664	85	29.40	66	3	88.0	4L	2500	1.8	87.0	4L	2600	4.0	N	91.5	82.3	N				
												2	89.0	4L	2700	1.8	88.0	4L	2650	4.0								
												4	88.0	4L	2700	1.8	87.0	4L	2600	4.0								

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

	VEHICLE DESCRIPTION							WEATHER				OCTANE NUMBER REQUIREMENT DATA								TANK FUEL INFORMATION							
						SPARK ADVANCE						MAXIMUM				PART THROTTLE							RATER			
OBS NO	MODEL CODE	E M C T	ENK SEN	C.R.	A I R	AS RCD	AS TST	ODOM MILES	AMB TMP	BAROM	HUM	F U E L	OCT NO	G E A R	RPM	MV	OCT NO	G E A R	RPM	MV	O W K N K	OCT NO RES	OCT NO MOT	N I T	T H R	G E A R	RPM	MV
28-29	MEAV P29A4	F	N	9.0	Y	+10	+10	8026	70	29.28	50	3	88.0	4U	2800	0.5	85.0	4U	2800	1.5				N			
												2	91.0	4U	2800	0.5											
												4	86.0	4U	2800	0.5											
08-01	NAR T25A3	F	N	8.3	Y			10024	90	29.83	101	3	89.0	3L	1400	3.0	87.0	3L	1375	5.0				N			
												2	90.0	3L	1400	3.0											
												4	85.0	3L	1400	3.0											
28-17	NAR T25A3	F	N	8.3	Y			10824	70	29.20	50	3	92.0	3U	2750	0.5	94.0	3U	2200	4.0				A	P	3U	2200	4.0
												2	95.0	3U	2600	0.5	98.0	3U	2200	3.0								
												4	88.0	2U	2400	0.5											
65-12	NAR T25A3	F	N	8.3	Y			10300	80	29.69	104	3					H	3L	2300	4.0							
												2					H	3L	2300	4.0							
												4					98.0	3L	2300	4.0							
65-13	NAR T25A3	F	N	8.3	Y			22350	87	29.65	114	3					H	3L	2200	3.5							
												2					H	3L	2200	3.5							
												4					98.0	3L	2200	3.5							
41-18	NAR T25A3	C	N	8.3	Y			15484	69	30.07	68	3	90.0	3L	2400	1.5								B	M	3L	2400	1.5
												2	91.0	3L	2400	1.5											
												4	88.0	3L	2400	1.5											
24-01	NAR T25A3	F	N	8.3	Y			12800	72	29.24	47	3	90.0	3U	2700	1.0	89.0	3U	2300	5.0	N	92.8	83.4	N			
												2	92.0	3U	2500	1.0	90.0	3U	2250	5.5							
												4	85.0	3U	3000	1.0											
62-05	NAW P28A3	B	Y	H	8.9	Y		8134	70	29.65		3	L				L							N			
				H								2	L				L										
				H								4	L				L										
				L								3	L				L										
				L								2	L				L										
				L								4	L				L										
47-08	NAW P28A3	C	Y	H	8.9	Y		16000	70	29.95	54	3	90.0	3L	2100	1.0	86.0	3L	2100	3.0							
				H								2	93.0	3L	2100	1.0											
				H								4	85.0	3L	2100	1.0											
				L								3	87.0	3L	2250	1.0											
				L								2	90.0	3L	2200	1.0											
				L								4	82.0	3L	2500	1.0											

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

VEHICLE DESCRIPTION									WEATHER				OCTANE NUMBER REQUIREMENT DATA								TANK FUEL INFORMATION						
						SPARK ADVANCE							MAXIMUM				PART THROTTLE							RATER		
OBS NO	MODEL CODE	EMCT	ENGINE SERIAL	C.R.	AIR	AS RCD	AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	OCT NO	GEAR	RPM	MV	OCT NO	GEAR	RPM	MV	OCTANE WINDOW	OCT NO RES	OCT NO MOT	INITIAL TRR	GEAR RPM	MV
65-03	NAW P28A3	F	Y H	8.9	Y			6950	81	29.57	82	3	94.0	3U	2900	2.0	90.0	3L	2300	2.5						
			H									2	95.0	3U	3125	2.0										
			H									4	88.5	3U	3125	2.0										
			L									3	93.5	3U	3175	2.0										
			L									2	94.5	3U	2750	2.0										
			L									4	88.5	3U	3125	2.0										
05-06	NAW P28A4	F	Y H	8.9	Y			5836	70	29.70	54	3	85.0	3L	2850	2.0					N	92.4	81.3	N		
			H									2	87.0	3L	3050	2.0										
			H									4	83.0	3L	2300	2.0										
			L									3	84.0	3L	2850	2.0										
			L									2	86.0	3L	3050	2.0										
			L									4	83.0	3L	2300	2.0										
29-13	NAW P28A4	F	Y H	8.9	Y			16300	70	30.10	50	3	86.0	3L	1900	1.2	85.5	3U	2000	2.7				N		
			H									2	88.5	3L	1900	1.2										
			H									4	84.5	2U	2300	0.6										
			L									3	86.0	3L	1900	1.2										
			L									2	88.5	3L	1900	1.2										
			L									4	84.5	2U	2300	0.6										
46-11	NAW P28A4	F	Y H	8.9	Y			7200	65	29.75	70	3	90.0	3U	2900	2.0	89.0	4L	1850	3.0	N	91.5	82.7	N		
			H									2	92.0	3U	2650	2.0										
			H									4	86.0	3U	3100	2.0										
			L									3	87.0	3U	1900	2.0										
			L									2	87.0	3U	2900	2.0										
			L									4	85.0	3U	3100	2.0										
07-13	NAW P28A4	F	Y H	8.9	Y			11813	72	29.68	42	3	L				L							N		
			H									2	80.0	4L	1900	2.0										
			H									4	78.0	3L	1900	2.5										
			L									3														
			L									2														
			L									4														
23-03	NBH 450A4	F	Y H	9.3	Y	0	0	9692	60	29.20	34	3	94.0	2U	2400	0.6	91.0	4L	1000	2.0	N			N		
			H									2	94.0	2U	2600	0.6										
			H									4	93.0	2U	2000	0.6										
			L									3	92.0	2U	2400	0.6										
			L									2	92.0	2U	2600	0.6										
			L									4	92.0	2U	2000	0.6										

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMCT	ENGSEN	AIR	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAX OCT NO	MAX GEAR	MAX RPM	MAX MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OWKN	RATER OCT NO RES	RATER OCT NO MOT	RATER INT	RATER THR	RATER GEAR	RATER RPM	RATER MV
22-11	NBY 450A4	F	Y H	8.0	Y +16	+20	14471	71	29.12	68	3	91.0	2U	2100	1.0	91.0	3U	1400	7.0	N			N				
			H								2	92.0	2U	3000	1.0												
			H								4	89.0	2U	2100	1.0												
			L								3	88.0	2U	2100	1.0												
			L								2	90.0	2U	3000	1.0												
			L								4	86.0	2U	2100	1.0												
41-06	NBY 450A4	C	Y H	8.0	Y +15	+12	11928	69	30.01	70	3	90.0	3U	2200	2.0					N			N				
			H								2	90.0	3U	2200	2.0												
			H								4	87.0	3U	2200	2.0												
			L								3	82.0	3U	2200	2.0												
			L								2	83.0	3U	2200	2.0												
			L								4	81.0	3U	2200	2.0												
23-20	NBZ T43A4	F	Y H	9.3	Y 0	0	13182	48	29.23	58	3	91.0	3U	3000	0.8	88.0	4L	1300	2.0	N			B	M	3U	2000	0.8
			H								2	92.0	2U	3100	0.8												
			H								4	90.0	3U	2000	0.8												
			L								3	87.0	2U	2800	0.8												
			L								2	87.0	2U	3000	0.8												
			L								4	86.0	3U	2000	0.8												
25-04	NBZ T43A4	F	Y H	9.3	Y 0	+ 6	6101	70	30.29	52	3					95.0	4L	1150	8.0	N	94.6	83.0	A	P	4L	1150	8.0
			H								2					96.0	4L	1150	8.0								
			H								4					91.0	4L	1175	8.0								
			L								3					95.0	4L	1150	8.0								
			L								2					95.0	4L	1150	8.0								
			L								4					90.0	4L	1150	8.0								
28-20	NBZ T43A4	F	Y H	9.3	Y		11442	70	29.36	50	3	91.0	2U	1900	0.5	F							N				
			H								2	91.0	2U	1900	0.5												
			H								4	89.0	2U	1900	0.5												
			L								3	89.0	2U	1900	0.5												
			L								2	90.0	2U	1900	0.5												
			L								4	89.0	2U	1900	0.5												
65-23	NBZ T43A4	F	Y H	9.3	Y		6128	80	29.52	78	3					89.0	4L	1150	4.0								
			H								2					90.0	4L	1150	5.0								
			H								4					98.5	4L	1100	3.0								
			L								3					88.5	4L	1100	4.0								
			L								2					87.5	4L	1150	6.5								
			L								4					88.5	4L	1100	3.0								

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMC T	ENK SEN	C.R.	AIR	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OWKN	TANK FUEL INFORMATION RATER OCT RES	RATER OCT MOT	RATER NIT	RATER GEAR	RATER RPM	RATER MV
06-15	NBZ T43A4	F	Y H	9.3	Y	0	0	24721	54	30.15	54	3	95.0	3L	1450	0.6	97.0	3L	1150	6.0							
			H									2	97.0	3L	1900	0.6	99.0	3L	1450	6.0							
			H									4	92.0	3L	1450	0.6											
			L									3	93.0	3L	1300	0.6	94.0	3L	1450	6.0							
			L									2	95.0	3L	1600	0.6	95.0	3L	1450	6.0							
			L									4	89.0	3L	1450	0.6											
23-08	NFE T50A4	F	Y H	9.2	Y	0	0	10496	54	29.25	50	3	89.0	3U	2100	1.0	87.0	3U	2000	2.0	N			N			
			H									2	90.0	3U	2100	1.0											
			H									4	89.0	3U	2000	1.0											
			L									3	87.0	3U	2100	1.0											
			L									2	88.0	3U	2100	1.0											
			L									4	87.0	3U	2000	1.0											
06-02	NFS P28A4	F	N	8.8	Y	-10	-10	6601	71	29.75	78	3	85.0	2L	3400	1.4					N	95.8	84.4	N			
												2	87.0	2L	3200	1.4											
												4	83.0	2L	3400	1.4											
08-17	NJ1 T20A3	F	N	9.0	Y			18777	77	29.90		3	89.0	3L	2400	1.5	87.0	3L	1750	7.5				N			
												2	90.0	3L	2400	1.5											
												4	85.0	3L	2350	1.5											
41-08	NJ1 T20A3	C	N	9.0	Y			25515	70	29.89	69	3	92.5	3L	2300	2.5								B	M	3L	2300	2.5
												2	94.0	3L	2300	2.5											
												4	89.0	3L	2300	2.5											
29-20	NJ1 T20A3	F	N	9.0	Y			18715	70	30.25	54	3	90.0	2U	2200	0.6	90.0	3U	2000	5.8	Y	91.3	82.2	A	M	2U	2700	0.6
												2					94.0	3U	1900	5.8							
												4	85.5	2U	2600	0.6											
06-24	NJW P28M5	F	Y H	8.9	Y			14081	49	29.96	25	3	93.0	4	1900	0.4	90.0	4	1800	1.4	N	99.6	87.1	N			
			H									2	91.0	3	2300	0.4											
			H									4	91.0	4	1600	0.4											
			L									3	90.0	4	1800	0.4											
			L									2	90.0	3	1900	0.4											
			L									4	89.0	4	1900	0.4											
65-24	NJW P28M5	F	Y H	8.9	Y			10530	60	29.54	54	3	90.5	4	1500	0.0	86.0	4	1900	1.0							
			H									2	90.5	4	1500	0.0											
			H									4	89.5	4	1500	0.0											
			L									3	90.5	4	1500	0.0											
			L									2	90.5	4	1500	0.0											
			L									4	89.5	4	1500	0.0											

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EM CT	KNK SEN	C.R.	AIR	SPARK ADVANCE RCD	SPARK ADVANCE TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAX OCT NO	MAX GEAR	MAX RPM	MAX MV	PART THR OCT NO	PART THR GEAR	PART THR RPM	PART THR MV	OWN KNK	OCT RES	OCT MOT	RATER KNK TRT	RATER GEAR	RATER RPM	RATER MV
08-09	NL1 T20A3	F	N	9.0	Y			6926	90	29.62	95	3	87.0	3L	2350	1.2	F							N			
												2	88.0	3L	2500	1.2											
												4	86.0	3L	2650	1.2											
47-36	NL1 T20A3	C	N	9.0	Y			8600	70	29.96	50	3	88.0	3L	2300	1.5	93.0	3L	2100	5.0							
												2	91.0	3L	2900	1.5	97.0	3L	2450	5.0							
												4	85.0	3L	2300	1.5											
05-11	NL1 T20A3	F	N	9.0	Y			10158	70	30.30	18	3	92.0	3L	1550	4.0	92.0	3L	2600	6.0	N	97.2	86.8	N			
												2	94.0	3L	1500	4.0	95.0	3L	2850	6.0							
												4	88.0	3L	1500	4.0	89.0	3L	2900	6.0							
29-05	NL1 T20A3	F	N	9.0				6052	70	30.20	40	3	92.5	3L	2200	1.1	92.5	3U	2000	6.0	Y	92.4	82.7	A	M	3U	2500	0.9
												2					98.0	3U	2200	6.0							
												4	87.5	2U	2400	0.8											
28-08	NL1 T20A3	F	N	9.0	Y			10417	70	29.29	50	3					92.0	3U	2400	5.0				B	P	3U	2100	5.0
												2					97.0	2U	2200	5.0							
												4	87.0	2U	2100	0.5											
29-06	NLW P28A3	F	Y	H	8.9	Y		15320	70	30.25	54	3	89.5	2U	2300	0.6	89.0	3U	2200	2.5				N			
				H								2	91.5	2U	2300	0.6											
				H								4	83.5	2U	2300	0.6											
				L								3	89.5	2U	2300	0.6											
				L								2	91.5	2U	2300	0.6											
				L								4	83.5	2U	2300	0.6											
06-03	NLW P28A3	F	Y	H	8.9	Y		10009	65	30.09	73	3	86.0	3L	2500	1.4	86.0	3U	2200	5.0	N	94.0	83.4	B	M	3L	2100	1.4
				H								2	88.0	3L	2200	1.4											
				H								4	84.0	3L	2300	1.4											
				L								3	86.0	3L	2500	1.4											
				L								2	88.0	3L	2200	1.4											
				L								4	84.0	3L	2300	1.4											
47-11	NLW P28A3	C	Y	H	8.9	Y		23100	70	29.85	58	3	99.0	3L	2000	2.0	F										
				H								2	101.0	3L	2000	2.0											
				H								4	96.0	3L	2000	2.0											
				L								3	97.0	3L	2500	2.0											
				L								2	99.0	3L	2000	2.0											
				L								4	94.0	3L	2000	2.0											

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

	VEHICLE DESCRIPTION							WEATHER				OCTANE NUMBER REQUIREMENT DATA								TANK FUEL INFORMATION							
													MAXIMUM				PART THROTTLE					RATER				
OBS NO	MODEL CODE	EMCT	KNK SEN	A/I R	SPARK ADVANCE RCD	SPARK ADVANCE TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	OCT NO	GEAR	RPM	MV	OCT NO	GEAR	RPM	MV	OWKN	OCT RES	OCT MOT	NKIT	GEAR	RPM	MV
46-09	NLW P28A3	F	Y H	8.9	Y		8207	70	29.41	75	3	84.0	3L	2500	1.0	L				N	93.0	93.0	N			
			H								2	85.0	3L	2400	1.0											
			H								4	81.0	2L		1.0											
			L								3	82.0	3U	2250	1.0	L										
			L								2	85.0	3U	2400	1.0											
			L								4	81.0	2L		1.0											
65-05	NLW P28A3	F	Y H	8.9	Y		12975	88	29.51	104	3	85.0	3U	3100	1.5											
			H								2	87.0	3U	3100	1.0											
			H								4	92.0	2L	2800	0.5											
			L								3	83.0	2L	2800	0.5											
			L								2	85.5	2L	2800	0.5											
			L								4	81.0	2L	2300	0.5											
41-09	NLW P28A3	C	Y H	8.9	Y		24000	70	.	69	3	95.0	3L	2600	2.0								B	M	3L	2600	2.0
			H								2	96.0	3L	2600	2.0											
			H								4	94.0	3L	2600	2.0											
			L								3	84.0	3L	2600	2.0											
			L								2	86.0	3L	2600	2.0											
			L								4	84.0	3L	2600	2.0											
41-32	NLW P28A3	C	Y H	8.9	Y		20194	74	29.97	66	3	94.0	3L	2750	2.0								B	M	3L	2750	2.0
			H								2	94.0	3L	2750	2.0											
			H								4	93.0	3L	2750	2.0											
			L								3	82.0	3L	2750	2.0											
			L								2	82.0	3L	2750	2.0											
			L								4	81.0	3L	2750	2.0											
26-08	NLW P28A3	E	Y H	8.9	Y		13331	75	29.95	82	3	89.0	2U	1200	0.0	88.0	3U	1900	2.5	N			B	M	2U	1250	0.0
			H								2	92.0	3L	2150	1.0											
			H								4	88.0	2U	1250	0.0											
			L								3	85.0	2U	1400	0.0											
			L								2	87.0	2U	1400	0.0											
			L								4	86.0	2U	1200	0.0											
23-21	NY8 P57A4	F	Y H	9.5	Y	+ 2 + 6	11105	42	29.13	18	3	93.0	4L	1200	1.2	93.0	4L	1200	2.0	N			B	M	4L	1200	1.2
			H								2	94.0	4L	1100	1.2											
			H								4	92.0	4L	1200	1.2											
			L								3	90.0	4L	1200	1.2											
			L								2	90.0	4L	1200	1.2											
			L								4	89.0	4L	1200	1.2											

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	SMCT	KNK SRN	C.R.	SPARK ADVANCE AIR	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	TANK FUEL INFORMATION OWNER	RATER OCT NO RES	RATER OCT NO MOT	RATER INTR	RATER THR	RATER GEAR	RATER RPM	RATER MV
41-18	NIM5 215A3	C	N	9.5	N	+ 6	+ 6	16605	70	29.90	68	3	87.0	2	3600	1.5	83.0	3	3600	2.5				N				
												2	88.0	3	3600	1.5												
												4	86.0	3	3600	1.5												
23-24	NIM5 210M5	F	N	9.5	N	+ 8	+ 8	11298	45	28.96	12	3	91.0	4	1600	0.6	91.0	4	1600	2.0	N			A	M	4	1600	0.6
												2	91.0	4	1600	0.6												
												4	90.0	4	1600	0.6												
47-09	NIR5 215A3	C	N	9.6	Y	+ 3	+ 3	18650	70	29.87	56	3	86.0	3	3300	1.0	85.0	3	3300	2.0								
												2	87.0	3	3300	1.0												
												4	85.0	3	2900	1.0												
06-19	NIT6 T16A3	F	N	8.6	Y	+10	+10	17793	60	29.85	52	3	93.0	3U	2700	1.0	94.0	3L	3100	7.0	N	95.0	83.8	A	P	3L	3000	7.0
												2	94.0	3L	3100	1.2	98.0	3L	3000	7.0								
												4	90.0	3U	2800	1.0												
29-23	NUCA 216A3	F	N	9.0	Y	+ 5	+ 5	11294	70	30.10	50	3					88.0	2	2400	2.5	Y	91.7	82.4	A	M	2	2300	1.0
												2	96.5	2	2250	1.0												
												4	87.0	3	1850	1.0												
41-26	NUCA 216A3	C	N	9.0	Y	+ 5	+ 5	8442	72	29.98	68	3	91.0	3	2600	2.0	F							B	M	3	2400	2.0
												2	92.0	3	2600	2.0												
												4	89.0	3	2600	2.0												
05-17	NUS4 216A3	F	N	9.0	N	+ 5	+ 5	11807	70	29.82	50	3	97.0	2U	4100	2.0	95.0	3L	3100	4.0	Y	92.6	82.0	A	M	2U	3650	2.0
												2	98.0	2U	4200	2.0												
												4	94.0	2U	4100	2.0												
07-15	NUS4 216M5	F	N	9.0	Y	+ 5	+ 5	7213	71	30.05	51	3	93.0	3	2400	0.6	F											
												2	93.0	3	3000	0.6								N				
												4	92.0	3	2700	0.6												
32-28	OBK 213M4	F	N	9.0	N	0	0	7475	76	29.51	24	3	L				81.0	4	1400	8.0	N			N				
												2	L				81.0	4	1700	8.0								
												4	L				81.0	4	1500	8.0								
47-23	OBK 213M4	C	N	9.0	N	0	0	9200	70	30.19	50	3	84.0	4	1600	0.5	81.0	4	1750	1.5								
												2	84.0	4	3600	0.5												
												4	83.0	4	1750	0.5												
28-25	OBK 213M5	F	N	9.0	Y	0	0	9545	70	29.35	50	3	87.0	4	1500	0.5	86.0	4	1500	1.2				N				
												2	87.0	4	1500	0.5												
												4	86.0	4	1500	0.5												
32-09	OC4 P38A4	F	N	9.0	Y	+10	+10	9730	85	29.71	69	3	90.0	4U	2200	1.3	91.0	3L	2050	5.0	Y	92.3	82.2	B	P	3U	2900	6.0
												2	91.0	3U	2500	1.3	92.0	3U	2400	5.0								
												4	90.0	3U	2100	1.3	91.0	3L	2000	5.0								

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMCT	ENG SEN	C.R.	SPARK ADVANCE AIR	SPARK ADVANCE RCD	SPARK ADVANCE TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OWNER	RATER OCT RES	RATER OCT MOT	RATER INT	RATER THR	RATER GEAR	RATER RPM	RATER MV
41-23	OD4 P38A4	C	N	9.0	Y	+10	+10	9373	64	29.97	67	3	89.0	4L	1800	2.0	F				N	91.8	82.6	N				
												2	90.0	4L	1800	2.0												
												4	87.0	4L	1800	2.0												
28-02	OD4 P38A4	F	N	9.0	Y	+10	+10	9666	70	29.25	50	3	89.0	3U	2700	1.0	90.0	3U	2050	4.0				N				
												2	90.0	3U	3200	1.0	93.0	3U	2100	5.0								
												4	88.0	4L	1600	1.0												
46-07	ODD T25A3	F	N	9.0	Y	+10	+10	14371	73	29.30	95	3	85.0	3	2200	1.5	83.0	3	1900	2.5		93.4	84.9	N				
												2	86.0	3	1950	1.5												
												4	83.0	3	2350	1.5												
32-04	ODD T25M5	F	N	9.0	Y	+10	+10	17510	85	29.06	64	3	93.0	4	1400	0.2	94.0	4	1400	2.0	N	91.3	82.3	B	M	4	1500	0.3
												2	92.0	4	1300	0.1	95.0	4	1400	2.0								
												4	94.0	4	1400	0.2	94.0	4	1400	2.0								
32-05	ODU P30A4	F	Y	H	9.3	Y	+10	+10	9421	85	29.53	68	3	87.0	4L	1750	0.9	87.0	4L	1800	2.0	N	91.3	82.3	N				
				H								2	87.0	4L	1500	0.9	87.0	4L	1900	2.0								
				H								4	87.0	4L	1850	0.9	87.0	4L	1900	2.0								
				L								3	84.0	4L	1800	0.9	84.0	4L	1900	2.0								
				L								2	85.0	3L	2100	0.9	85.0	3L	2200	2.0								
				L								4	84.0	4L	1850	0.9	84.0	4L	1950	2.0								
32-06	ODU P30A4	F	Y	H	9.3	Y	+10	+10	12004	85	29.40	65	3	84.0	4L	1600	0.8	84.0	4L	1600	2.0	N	91.0	83.7	N				
				H								2	86.0	3U	2600	1.0	86.0	3U	2600	2.0								
				H								4	84.0	4L	1600	0.8	83.0	4L	1700	2.0								
				L								3	84.0	4L	1600	0.8	84.0	4L	1600	2.0								
				L								2	85.0	4L	1500	0.8	85.0	3U	2600	2.0								
				L								4	82.0	4L	1600	0.8	82.0	4L	1800	2.0								
41-22	ODU P30A4	C	Y	H	9.3	Y	+10	+10	10088	67	30.08	68	3	97.0	4L	2000	1.5	F							B	M	4L	2000	1.5
				H								2	97.0	4L	2000	1.5												
				H								4	95.0	4L	2000	1.5												
				L								3	85.0	4L	2000	1.5												
				L								2	86.0	4L	2000	1.5												
				L								4	83.0	4L	2000	1.5												
06-11	ODU P30A4	F	Y	H	9.3	Y	+10	+10	39942	68	29.89	60	3	93.0	3U	2900	0.4	94.0	4U	1700	4.0								
				H								2	94.0	3U	2400	0.4	95.0	4U	1600	5.0								
				H								4	92.0	4U	1600	0.4												
				L								3	91.0	3L	1900	0.4	92.0	4U	1800	4.0								
				L								2	92.0	3U	2800	0.4	94.0	4U	1500	5.0								
				L								4	91.0	4U	1600	0.4												

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMCT	KNK SEN	C.R.	SPARK ADVANCE AIR	SPARK ADVANCE ASRCD	SPARK ADVANCE ASTST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OWNK	RATER OCT NO RBS	RATER OCT NO MOT	RATER NITR	RATER GEAR	RATER RPM	RATER MV
28-26	ODU P30A4	F	Y H	9.3	Y	+10	+10	18978	70	29.32	50	3	93.0	3U	3100	0.5	95.0	4L	1800	5.5				B	P	4L	1500	5.5
			H									2	95.0	3U	3500	0.5	96.0	4L	1800	5.5								
			H									4	92.0	4L	1700	0.5												
			L									3																
			L									2																
			L									4																
65-08	ODU P30A4	F	Y H	9.3	Y	+10	+10	12493	76	29.55	88	3					96.0	4L	1600	5.5								
			H									2					95.5	4L	1600	5.5								
			H									4					93.5	4L	1600	5.5								
			L									3					95.5	4L	1600	5.5								
			L									2					95.5	4L	1600	5.5								
			L									4					93.5	4L	1600	5.5								
87-17	ODU P30A4	F	Y H	9.3	Y			7379	71	30.32	48	3	94.0	4L	1900	1.5	92.0	4L	1900	8.0	O	92.0	82.3	A	M	4L	1800	1.5
			H									2	94.0	4L	1800	1.5												
			H									4	92.0	4L	1900	1.5												
			L									3	92.0	4L	1900	1.5	91.0	4L	1900	8.0								
			L									2	92.0	4L	1800	1.5	92.0	4L	1900	8.0								
			L									4																
29-27	ODU P30A4	F	Y H	9.3	Y	+10	+10	26822	70	30.00	40	3					94.0	3U	1600	7.5	Y	92.0	82.4	A	M	3U	1500	0.4
			H									2					97.0	3U	1300	7.5								
			H									4	90.0	3U	2300	0.4												
			L									3					93.0	3U	1700	7.5								
			L									2					96.0	3U	1700	7.5								
			L									4	90.0	3U	2300	0.4												
29-24	ODU P30A4	F	Y H	9.3		+10	+10	24275	70	30.08	50	3					97.0	3U	1500	8.0	Y	92.0	82.6	A	M	3L	1500	30.1
			H									2					100.5	3L	1650	5.0								
			H									4	94.5	3U	2000	0.5												
			L									3					97.0	3U	1500	8.0								
			L									2					100.5	3L	1650	5.0								
			L									4	94.5	3U	2000	0.5												
29-21	ODU P30A4	F	Y H	9.3	Y	+10	+10	18227	70	30.25	50	3	95.5	2U	2800	0.4					Y	92.0	82.5	A	M	4L	1300	0.6
			H									2	96.0	3L	1500	0.6	95.0	3U	1650	6.0								
			H									4	93.0	4L	1500	0.6												
			L									3	95.5	2U	2800	0.4												
			L									2	96.0	3L	1500	0.6												
			L									4	93.0	4L	1500	0.6												

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMCT	KNK SEN	SPARK ADVANCE AIR C.R.	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OWKN	RATER OCT RES	RATER OCT MOT	RATER NIT	RATER THR	RATER GEAR	RATER RPM	RATER MV
05-29	ODU P30A4	F	Y H	9.3	Y	+10	+10	5930	70	30.10	28	3	90.0	4L	1150	1.2	90.0	3L	1400	5.0	N	96.4	87.8	N				
			H									2	90.0	4L	1150	1.2	90.0	3L	1300	5.0								
			H									4	88.0	4L	1150	1.2	97.0	3L	1350	5.0								
			L									3	87.0	4L	1250	1.2	97.0	3L	1300	5.0								
			L									2	89.0	4L	1100	1.2												
			L									4	87.0	4L	1100	1.2												
29-01	ODU P30A4	F	Y H	9.3	Y	+10	+10	19922	70	30.20	54	3					93.0	3U	1300	4.5	Y	91.8	82.2	A	P	4L	1350	2.5
			H									2					94.0	3U	1300	4.0								
			H									4	89.5	2L	1300	0.6												
			L									3					93.0	3L	1300	4.5								
			L									2					93.0	3L	1700	5.0								
			L									4	89.5	3L	1600	0.6												
05-22	ODU P30A4	F	Y H	9.3	Y	+10	+10	13641	69	29.84	50	3	95.0	4L	1500	1.4					N	93.4	84.4	A	M	4L	1450	1.4
			H									2	96.0	4L	1500	1.4												
			H									4	92.0	4L	1500	1.4												
			L									3	94.0	4L	1500	1.4												
			L									2	95.0	4L	1600	1.4												
			L									4	92.0	4L	1500	1.4												
47-07	ODU P30A4	C	Y H	9.3	Y	+10	+10	11400	70	29.90	50	3	94.0	2U	3850	0.4	94.0	4L	1200	5.0								
			H									2	95.0	2U	3900	0.5												
			H									4	91.0	4L	1500	0.5												
			L									3	93.0	2U	3850	0.4	93.0	4L	1200	5.0								
			L									2	94.0	2U	3900	0.5												
			L									4	90.0	4L	1400	0.5												
32-12	OE9 T19A3	F	N	9.0	Y	+10	+10	12049	85	29.81	64	3	87.0	3	2400	0.6	87.0	3	1600	4.0	Y	91.3	83.6					
												2	87.0	3	2000	0.7	87.0	3	1500	4.0								
												4	86.0	3	2400	0.6	86.0	3	1600	4.0								
29-10	OE9 T19A3	F	N	9.0	Y	+10	+10	17082	70	30.30	40	3	87.5	3	1400	0.6	87.5	3	1400	3.5	N							
												2	87.5	3	1450	0.6												
												4	87.5	3	1400	0.6												
06-17	OE9 T19A3	F	N	9.0	Y	-10	-10	12411	65	29.75	65	3	92.0	3	1500	1.3	92.0	3	1500	4.0	N	95.1	84.2	B	M	3	1500	1.3
												2	90.0	3	1400	1.4												
												4	92.0	3	1400	1.4												
26-05	OE9 T19A3	E	N	9.0	Y	+10	+10	6780	89	29.52	85	3	92.0	2	1300	0.5	90.0	3	1400	4.0				N				
												2	92.0	2	1500	0.5												
												4	92.0	3	1300	0.5												

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMCT	ENG SEN	C.R.	SPARK ADVANCE AIR	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	TANE FUEL INFORMATION DWKN	TANE FUEL INFORMATION OCT NO RES	TANE FUEL INFORMATION OCT NO MOT	RATER INTR	RATER GEAR	RATER RPM	RATER MV
47-26	GE9 T19M4	C	N	9.0	N	+10	+10	14400	70	30.10	50	3	91.0	4	1500	0.0	F										
												2	91.0	4	1500	0.0											
												4	91.0	4	1510	0.0											
32-01	GE9 T19M5	F	N	9.0	Y	+14	+10	8144	85	29.06	73	3	87.0	4	1500	0.1	86.0	4	1700	2.0	Y			N			
												2	87.0	4	1400	0.1	87.0	4	1500	2.0							
												4	86.0	4	1500	0.1	86.0	4	1400	2.0							
08-10	OFA P23A4	C	Y	H	9.5	Y	+10	+10	6243	75	29.73	102	3	88.0	3U	3000	0.5	F							N			
				H								2	89.0	3U	3000	0.5											
				H								4	87.0	3U	3000	0.5											
				L								3	87.0	3U	3000	0.5											
				L								2	88.0	3U	3000	0.5											
				L								4	86.0	3U	3000	0.5											
08-22	OFA P23A4	C	Y	H	9.5	Y	+10	+10	7384	75	29.99	53	3	87.0	3U	2850	0.5	F							N			
				H								2	89.0	3U	2850	0.5											
				H								4	88.0	3U	2650	0.5											
				L								3																
				L								2																
				L								4																
05-09	OFA P23A4	F	Y	H	9.5	Y	+10	+10	20110	70	29.90	28	3	90.0	3U	2650	1.5	F										
				H								2	90.0	3U	2650	1.5											
				H								4	89.0	4U	2650	2.0											
				L								3	87.0	3U	3100	1.5											
				L								2	87.0	3U	2850	1.5											
				L								4	87.0	3U	2950	1.5											
26-04	OFA P23A4	E	Y	H	9.5	Y			7350	87	29.89	72	3	84.0	3U	2600	0.5	80.0	4L	1900	2.0				N			
				H								2	86.5	3U	3400	0.5											
				H								4	84.0	3U	2900	0.5											
				L								3																
				L								2																
				L								4																
32-09	OFA P23M5	F	Y	H	9.5	Y	+10	+10	23395	85	29.49	64	3	87.5	4	1600	0.1	87.5	4	1400	2.0	N	92.0	92.9	N			
				H								2	87.5	4	1400	0.1	88.0	4	1400	2.0							
				H								4	88.0	4	1300	0.1	86.5	4	1300	2.0							
				L								3	87.5	4	1600	0.1	87.5	4	1400	2.0							
				L								2	87.5	4	1400	0.1	88.0	4	1400	2.0							
				L								4	87.0	4	1400	0.1	86.5	4	1300	2.0							

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	ENG CT	ENG SEN	C.R.	AIR	SPARK ADVANCE RCD	SPARK ADVANCE TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OWN KEN	RATER OCT RES	RATER OCT MOT	RATER INT	RATER THR	RATER GBA	RATER RPM	RATER MV
06-23	OFE P50A4	F	N	9.0	Y	+10	+10	15430	60	29.40	41	3	93.0	4	1200	0.4	93.0	4	1300	3.0	N	99.5	87.5	N				
												2	93.0	4	1400	0.4	95.0	4	1400	3.0								
												4	93.0	4	1300	0.4												
46-13	OFE P50M5	F	N	9.2	Y	+10	+10	12307	74	29.70	73	3	92.0	3	2400	1.0	88.0	4	1450	1.5	N	95.2	87.3	N				
												2	93.0	3	2500	1.0												
												4	92.0	3	2200	1.0												
32-25	OPF P50A4	F	N	8.9	Y	+ 8	+10	23266	85	29.38	65	3	90.0	4	1200	1.5	88.0	4	1200	4.0	N	91.2	82.2	B	M	4L	1200	1.5
												2	90.0	4	1250	1.5	88.0	4	1200	4.0								
												4	89.0	4	1200	1.5	88.0	4	1200	4.0								
62-06	OPF P50A4	F	N	8.9	Y	+10	+10	16764	77	29.62		3	86.0	4	1600	0.0	85.0	3	1250	2.0	N			N				
												2	85.5	4	1700	0.0	86.5	3	1100	0.6								
												4	87.5	4	1500	0.4												
05-10	OPF P50A4	F	N	8.9	Y	+10	+10	21480	69	30.42	50	3					95.0	4	1500	8.0	N	92.5	82.9	A	M	4	1300	2.0
												2					96.0	4	1550	8.0								
												4	93.0	3	2400	1.5												
28-28	OPF P50A4	F	N	8.9		+10	+10	6956	70	29.41	50	3	83.0	4	1300	1.5	82.0	4	1000	8.0				N				
												2	82.0	4	1500	1.0	84.0	4	1000	8.0								
												4	83.0	4	1600	1.0												
41-24	OPF P50A4	C	N	8.9	Y	+10	+10	8296	67	30.16	66	3	87.0	4	1800	1.5								N				
												2	88.0	4	1800	1.5												
												4	86.0	4	1800	1.5												
06-16	OPF P50A4	F	N	8.9	Y	+10	+10	43335	60	30.01	69	3	92.0	4	1100	0.6	92.0	4	1100	1.6								
												2	90.0	4	1000	0.6												
												4	93.0	4	1100	0.6												
47-04	OS4 P38A4	C	N	9.0	Y	+10	+10	11604	70	29.92	53	3	91.0	3	2800	0.4	F											
												2	92.0	3	2350	0.4												
												4	88.0	2	2000	0.4												
05-21	OS4 P38A4	F	N	9.0	Y	+10	+10	6178	70	29.40	28	3	96.0	2	3000	1.0	F				N	96.4	87.8	N				
												2	97.0	2	3000	1.0												
												4	95.0	2	2900	1.0												
22-11	OSF P50A4	F	N	8.9	Y	+10	+10	19948	85	29.74	69	3	87.0	3	1800	0.8	87.0	3	1700	3.0	N	92.0	82.8	N				
												2	88.0	2	2700	0.8	87.0	3	1500	3.0								
												4	87.0	3	1700	0.8	87.0	3	1850	3.0								

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMCT	KNK SEN	SPARK ADVANCE AIR	C.R.	AS RCD	AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OWNK	RATER OCT NO RBS	RATER OCT NO MOT	RATER INT	RATER THR	RATER GEAR	RATER RPM	RATER MV
32-24	CSWTP23M5	F	Y H	8.0	Y	+10	+10	23120	86	29.47	64	3	88.0	4	1600	-4.0	88.0	4	1600	-2.0	N	91.1	82.2	B	M	4	1600	-4.0
			H									2	90.0	4	1600	-4.0	90.0	4	1600	-2.0								
			H									4	87.0	4	1600	-4.0	87.0	4	1600	-2.0								
			L									3	88.0	4	1600	-4.0	88.0	4	1600	-2.0								
			L									2	90.0	4	1600	-4.0	90.0	4	1600	-2.0								
			L									4	87.0	4	1600	-4.0	87.0	4	1600	-2.0								
32-02	OTS P23A3	F	N	9.0	Y	+15	+15	8071	85	29.35	66	3	87.0	3	2500	1.0					N	91.6	82.7	N				
												2	87.0	3	2100	1.0	88.0	3	1900	4.0								
												4	86.0	3	2000	1.0	86.0	3	1600	4.0								
05-14	OTX P23A3	F	N	9.0	Y	+10	+10	8672	70	30.30	28	3	91.0	3	2900	1.5	88.0	3	2300	6.0								
												2	93.0	3	2850	1.5												
												4	90.0	3	2800	1.5												
41-21	OTX P23A3	C	N	9.0	Y	+15	+15	11143	67	29.91	66	3	92.5	3	2800	1.0								B	M	3	2800	1.0
												2	94.0	3	2800	1.0												
												4	89.0	3	2800	1.0												
47-12	OTX P23M5	C	N	9.0	Y	+15	+15	10100	70	30.00	50	3	91.0	4	2600	0.0												
												2	93.0	4	2600	0.0												
												4	90.0	4	2600	0.0												
25-05	PBK T25A3	F	N	9.0	Y	+12	+12	17271	70	29.22	50	3	L				L							N				
												2	L															
												4	78.5	2U	3200	0.5	78.0	2U	2300	2.0								
29-18	PBK T25A3	F	N	9.0	Y	+12	+12	6925	70	30.20	54	3	83.0	2U	2100	0.6	83.0	2U	1900	2.0	N			N				
												2	83.0	2U	2600	0.6												
												4																
47-01	PKD T22A3	C	N	9.5	Y	+12	+12	8019	70	29.96	58	3	84.0	3L	2150	0.5	82.0	3L	2200	1.5								
												2	84.0	3L	2150	0.5												
												4	84.0	3L	2100	0.5												
47-02	PKD T22A3	C	N	9.5	Y	+12	+12	9000	70	30.00	56	3	85.0	3L	2700	0.5	83.0	3L	2450	1.5								
												2	85.0	3L	2850	0.5												
												4	85.0	3L	2100	0.5												
40-01	PKD T22A3	F	N	9.5	Y			7667	68	29.82	22	3	85.0	3U	2800	1.0	F							N				
												2	85.0	2U	3300	1.0												
												4	85.5	3L	2400	1.0												
41-19	PKD T22A3	C	N	9.5	Y	+12	+12	18509	67	30.04	68	3	89.0	3L	2400	1.5	F							N				
												2	90.0	3L	2400	1.5												
												4	87.0	3L	2400	1.5												

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMCT	ENG SEN	C.R.	SPARK ADVANCE AIR	SPARK ADVANCE ASRCD	SPARK ADVANCE ASTST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	TANK FUEL INFORMATION OWNER	RATER OCT NO RBS	RATER OCT NO MOT	RATER ENGINE THROTTLE	RATER GEAR	RATER RPM	RATER MV
25-07	PKK T25A3	F	N	9.0	Y	+12	+12	15684	70	29.24	50	3	83.0	2U	1900	0.5	82.0	2U	1900	1.5				N			
												2	83.0	3U	1800	2.5											
												4	83.0	2U	1900	0.5											
08-14	PPD T22A3	A	N	9.5	Y	+12	+12	19788	90	29.87	139	3	84.0	3U	1950	1.0	80.0	3U	1950	3.0				N			
												2	84.0	3U	1950	1.0											
												4	83.0	3U	1950	1.0											
08-20	PPD T22A3	A	N	9.5	Y	+12	+12	17956	82	29.78	120	3	87.0	3U	2050	1.0	84.0	3U	1950	5.0				N			
												2	89.0	2U	2250	0.5											
												4	86.0	3U	2150	1.0											
25-04	PPD T22A3	F	N	9.5	Y	+12	+12	13535	70	29.10	50	3	84.0	3L	2100	0.5	84.0	3U	2000	2.0				N			
												2	84.0	3U	2100	0.5	85.0	3U	2500	2.0							
												4	83.0	3U	2300	0.5											
07-10	PPD T22A3	F	N	9.5	Y	+ 8	+12	8321	72	30.20	34	3	89.0	2U	3200	1.0	F				N	96.2	84.7	N			
												2	90.0	2U	3500	1.0											
												4	87.0	3U	2500	0.8											
07-08	PPD T22A3	F	N	9.5	Y	+ 8	+12	16514	68	29.98	40	3	90.0	3U	2800	0.8	F							N			
												2	90.0	2U	3200	1.3	90.0	3U	2700	5.0							
												4	88.0	3U	2800	0.8											
06-22	QB9 P27A4	F	Y	H	9.5	Y	+20	+20	10237	45	30.11	37	3	94.0	3U	2600	0.7	94.0	3L	2500	4.0	N	100.0	88.0	B	N	4L	1950	0.7
				H								2	96.0	4L	2650	0.7	96.0	4L	1900	4.0							
				H								4	92.0	4L	1700	0.7											
				L								3	94.0	3U	3600	1.0											
				L								2	95.0	4L	1900	0.7											
				L								4	92.0	4L	1700	1.0											
41-03	QC5 T18M5	C	N	9.5	N	+20	+20	9437	70	29.93	70	3	84.0	4	2500	0.5					N	82.1	81.5				
												2	85.0	4	2500	0.5											
												4	84.0	4	2500	0.5											
65-28	QD5TP18M5	F	N	7.7	Y	+20	+20	6800	52	29.32	30	3	88.0	4	3200	-8.0											
												2	90.0	4	3500	-8.0											
												4	88.0	4	3200	-8.0											
28-21	RBJ P30A4	F	Y	H	9.3	Y			11128	70	29.36	50	3	91.0	3U	1500	1.5	95.0	3U	1550	5.0				B	P	3U	1500	5.0
				H								2	93.0	3U	1500	1.5	96.0	3U	1550	5.0							
				H								4	89.0	3U	1500	1.5	91.0	3U	1550	5.0							
				L								3															
				L								2															
				L								4															

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMCT	ENGINE SEN	C.R.	SPARK ADVANCE AIR	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL BLK	MAX OCT NO	MAX GEAR	MAX RPM	MAX MV	PART THR OCT NO	PART THR GEAR	PART THR RPM	PART THR MV	OWNK	RATER OCT NO RES	RATER OCT NO MOT	RATER INT	RATER THR GEAR	RATER RPM	RATER MV
32-15	SPF P50A4	F	N	8.9	Y	+ 8	+10	26780	85	29.49	66	3	89.0	4	1400	1.0	89.0	4	1300	3.0							
												2	89.0	4	1500	1.0	89.0	4	1250	3.0							
												4	89.0	4	1500	1.0	89.0	4	1150	3.0							
06-18	SPF P50A4	F	N	8.9	Y	- 6	-10	15373	59	29.75	62	3	94.0	4	1500	0.4	93.0	4	1400	7.0	N	99.4	96.3	N			
												2	94.0	4	1400	0.4	95.5	3	1700	5.0							
												4	93.0	3	1600	0.4											
60-02	TAE 115M5	F	N	9.3	Y	+ 3	+ 3	9687	72	29.56		3	87.0	5	1700	0.0	87.0	5	1250	11.0	N			N			
												2	86.0	4	1600	0.0	89.0	5	1300	10.0							
												4	95.0	4	1700	0.0				3.0							
28-11	TAE 115M5	F	N	9.3	Y	+ 3	+ 3	10288	70	29.13	50	3					88.0	3	1300	10.0				N			
												2					92.0	3	1300	10.0							
												4	88.0	3	1200	0.5											
08-07	TAE 215A3	F	N	9.3	Y	+ 3	+ 3	6641	84	29.95	67	3	89.0	2U	4100	1.0	F							N			
												2	91.0	2U	3700	1.0											
												4	86.0	2U	3100	1.0											
08-21	TBA 216A3	F	N	9.5	Y	+ 5	+ 5	6613	78	30.09	44	3	82.0	2L	3700	1.0	L							N			
												2	84.0	2L	3700	1.0											
												4	80.0	3L	2500	1.6											
41-29	TBA 216A3	C	N	9.5	Y	+ 5	+ 5	6174	67	30.07	68	3	87.0	3L	2800	1.5	85.0	3L	2800	2.5	N	91.8	83.6	N			
												2	88.0	3L	2800	1.5											
												4	85.0	3L	2800	1.5											
47-05	TBA 216A4	C	N	9.5	Y	+ 5	+ 5	6250	70	29.93	53	3	87.0	3L	4000	1.5	84.0	4L	2400	2.5							
												2	90.0	3L	4000	1.5											
												4	84.5	3L	3150	1.5											
60-03	TBA 216M5	F	N	9.5	N	+ 5	+ 5	14502	73	29.91		3	86.0	4	2500	0.0	86.0	5	2500	3.0				N			
												2	87.0	4	2500	0.0											
												4	85.5	4	1500	0.0											
60-05	TDS P20A4	F	N	9.3	Y	+11	+11	7490	74	29.65		3	82.0	4L	1800	0.8	82.0	3L	2100	1.5							
												2	82.0	4U	2100	1.0											
												4	82.0	4U	2300	1.0											
60-06	TES P20A4	F	N	9.3	Y	+15	+10	6671	74	29.30		3	82.0	4L	1700	0.8	82.0	3U	2300	2.0				N			
												2	83.0	2U	2400	0.4											
												4	83.0	3U	2300	0.8											
62-08	TES P20A4	F	N	9.3	Y	+12	+10	16919	78	29.63		3	90.5	4L	1600	0.6	91.0	4U	2000	2.0				A	M	4L	2100	3.6
												2	91.0	4U	1900	1.0	93.0	3U	1900	3.0							
												4	89.0	4L	1700	0.6											

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMC T	ENK SEN	C.R.	SPARK ADVANCE AIR	AS RCD	AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OWNER	RATER OCT NO RES	RATER OCT NO MOT	RATER INT	RATER THR	RATER GEAR	RATER RPM	RATER MV
05-20	TBS P20A4	F	N	9.3	Y	+10	+10	6102	70	30.20	28	3	89.0	3U	2400	2.0	90.0	3U	2350	4.0	N	96.4	87.8					
												2	91.0	3U	2350	2.0	92.0	3U	2400	4.0								
												4	89.0	3U	2500	2.0	89.0	3U	2400	4.0								
28-04	TBS P20A4	F	N	9.3	Y	+10	+10	10198	70	.	50	3	88.0	2U	2000	0.5	89.0	3U	2000	1.5								
												2	89.0	2U	2000	0.5	90.0	3U	2100	1.5								
												4	88.0	2U	2100	0.5												
41-11	TBS P20A4	C	N	9.3	Y	+10	+10	20163	70	29.92	70	3	94.0	3L	2200	1.0	92.0	3L	2200	2.0	Y	91.4	83.0	B	M	3L	2200	1.0
												2	95.0	3L	2200	1.0												
												4	93.0	3L	2200	1.0												
06-06	TBS P20A4	F	N	9.3	Y	+15	+10	41468	75	29.82	86	3	87.0	4U	1700	0.4	86.0	4U	1700	1.4		99.1	87.7					
												2	87.0	4U	1700	0.4												
												4	86.0	3L	2300	0.4												
26-03	TBS P20A4	E	N	9.3	Y	+10	+10	7721	86	30.08	91	3	89.0	4L	1800	0.5	86.0	4L	1800	3.0				N				
												2	90.0	4L	1750	0.5												
												4	89.0	4L	1850	0.5												
65-22	TBS P20M5	F	N	9.3	N	+10	+10	7813	80	29.52	78	3	92.5	4	2800	0.0	91.5	3	2500	3.0								
												2	92.5	4	2500	0.0												
												4	92.5	4	2200	0.0												
60-09	TPM P28A4	F	Y	H	9.2	Y	+10	+10	6377	76	29.44		3	85.0	4L	2000	0.6	85.0	3U	1900	2.0				N				
				H								2	86.0	3U	2100	0.5												
				H								4	85.0	4L	1700	0.5												
				L								3																
				L								2																
				L								4																
06-25	TPM P28A4	F	Y	H	9.2	Y	+12	+10	13143	53	29.75	35	3	93.0	3U	2000	0.4	94.0	3L	2300	2.0	N	92.8	82.2	B	M	4L	2000	0.4
				H								2	94.0	3L	2000	1.0												
				H								4	93.0	3U	2000	0.4												
				L								3	89.0	3U	2000	0.4	90.0	3L	2000	2.0								
				L								2	90.0	3L	2000	1.0												
				L								4	88.0	3U	2000	0.4												
60-08	TGMTP30M5	F	Y	H	8.4	Y			9984	71	29.35		3	L			83.0	4	3300	-2.0				N				
				H								2	80.0	3	4500	-6.0	93.0	4	3000	-2.0								
				H								4	L				80.0	4	3000	-2.0								
				L								3	L				83.0											
				L								2	L				82.0											
				L								4	L				90.0											

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	BMC T	KNK SEN	SPARK ADVANCE AIR C.R.	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OCTANE WORK	RATER OCT NO RES	RATER OCT NO MOT	RATER INT	RATER THR	RATER GEAR	RATER RPM	RATER MV
06-21	VA P23A3	F	Y H	9.8	Y	+12	+12	8196	51	30.12	35	3	92.0	3	2500	3.5	89.0	3	2500	4.5	N	98.5	86.6	N				
			H									2	93.0	3	2700	3.3												
			H									4	91.0	3	2300	3.5												
			L									3	90.0	3	2900	3.2												
			L									2	91.0	3	2700	3.2												
			L									4	89.0	3	2800	3.2												
65-17	VC P23A4	F	Y H	8.7	Y	+12	+12	22310	65	29.29	61	3					94.0	4	2900	-2.5								
			H									2					94.0	4	2900	-2.5								
			H									4					94.5	4	2900	-2.5								
			L									3					93.5	4	2900	-2.5								
			L									2					93.5	4	2900	-2.5								
			L									4					94.5	4	2900	-2.5								
07-01	ZA P16M5	F	N	9.3	Y	+ 2	+ 2	18100	72	30.40	50	3	87.0	4	3400	0.2	F				N	94.3	84.0	N				
												2	89.0	3	3400	0.5												
												4	87.0	4	3500	0.2												
47-21	ZB P22A4	C	N	8.6	Y	+ 6	+ 6	8800	70	30.01	50	3	88.0	4L	2250	0.8	F											
												2	89.0	4L	2250	0.8												
												4	85.0	4L	2300	0.8												
46-15	ZB P22A4	F	N	8.6	Y	+ 6	+ 6	8249	84	29.00	112	3	82.0	3U	2200	1.0	L				N	92.2	85.8	N				
												2	84.0	3U	2400	1.0												
												4	80.0	3U	2600	1.0												
47-24	ZB P22M5	C	N	8.6	Y	+ 6	+ 6	6000	70	30.12	50	3	84.0	4	1200	0.5	F											
												2	84.0	4	1400	0.5												
												4	84.0	4	1200	0.5												
07-11	ZB TP22A4	F	N	7.8		+ 9	+ 9	8122	72	30.50	43	3	86.0	4U	2000	7.0	F				N	99.8	88.2	N				
												2	86.0	2U	3100	9.0												
												4	85.0	3U	2900	9.0												
07-20	ZB TP22A4	F	N	7.8	Y	+ 9	+ 9	9505	68	30.27	52	3	84.0	3U	3100	-7.0	F				N	99.8	88.2	N				
												2	86.0	4U	2700	-7.0												
												4	84.0	3U	3000	-7.0												
05-15	ZC P13A4	F	N	9.4	Y	- 5	- 5	6321	70	30.10	34	3	91.0	3U	2600	0.8	F				N	93.0	81.0	N				
												2	91.0	3U	3100	0.8												
												4	91.0	3U	3400	0.8												
65-20	ZD TP22M5	F	N	8.6	Y	+ 9	+ 9	6500	69	29.12	72	3					93.0	4	3000	-8.0								
												2	90.5	2	4000	-6.5												
												4	93.0	4	2750	-8.5												

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	BMC T	ENK SEN	C.R.	AIR	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OCTANE WORK SEN	RATER OCT RES	RATER OCT MOT	RATER INT	RATER THR	RATER GEAR	RATER RPM	RATER MV
62-09	ETSIH T30A4	F	N	9.0	Y	+12	+12	10044	83	28.78	38	3	84.0	3U	2200	1.0	82.0	4U	2300	0.8				N				
												2	84.0	4L	2400	0.5												
												4	82.0	3U	2200	1.0												
62-10	ETVGS T24A3	F	N	8.3	Y	+10	+10	24176	78	29.60		3	86.0	4L		0.4	87.0	4U		1.0				N				
												2	88.0	4U		0.4												
												4	86.0	4L		0.4												
07-19	KTPDY T52A3	F	N	9.2	Y	+10	+10	9160	68	30.20	52	3	92.0	2U	3000	1.0	F				N	96.6	83.4					
												2	92.0	2U	3000	1.0												
												4	89.0	3U	2200	2.0												
25-11	KTPNX T39A3	F	N	9.2	Y	+10	+10	6351	78	29.55		3	88.0	3U	2400	1.0	87.0	3U	1700	2.5	N			A	P	3		3.0
												2	87.5	3U	2600	1.0	91.0	3U	2400	3.0								
												4	88.0	3U	2400	1.0												
46-21	KTPNX T39A3	F	N	9.2	Y	+10	+10	16207	80	29.31	78	3	89.0	3L	1800	1.0	88.0	3L	2050	2.0	N	90.9	83.2	N				
												2	88.0	3L	1750	1.0												
												4	86.0	3L	1900	1.0												
47-28	KTPNX T39A4	C	N	9.2	Y	+10	+10	6100	70	30.19	54	3	90.0	4L	1600	2.0	90.0	4L	1900	3.0								
												2	90.0	4L	1700	2.0												
												4	87.5	4L	1700	2.0												
07-05	KTPNX T39M4	F	N	9.2	N	+ 8	+ 8	6616	72	30.02	51	3	91.0	3	2000	0.3	90.0	4	2100	7.0	N	92.4	82.2	A	M	3	1800	0.2
												2	91.0	4	1500	0.3	91.0	4	1600	7.0								
												4	90.0	3	1900	0.3												
25-16	KTVBY T52A3	F	N	9.2	Y	+14	+10	15506	76	29.33		3	83.0	3	2800	1.5	L							N				
												2	84.5	3	2900	2.0												
												4	80.0	3	3000	1.0												
29-30	KTVBY T52A3	F	N	9.2	Y	+10	+10	11666	70	30.10	54	3	94.0	3U	2250	0.8	L				Y	92.1	82.7	B	M	3U	2100	0.8
												2	93.0	3U	2200	0.8												
												4	93.0	3U	2250	0.8												
28-01	KTVBY T52A3	F	N	9.2	Y	+10	+10	9548	70	29.35	50	3	88.0	2U	3700	0.5	86.0	3U	2000	2.0								
												2	91.0	2U	3600	0.5												
												4	87.0	2U	2500	0.5												
26-06	KTVBY T52A3	B	N	9.2	Y			7545	85	30.00	109	3	90.0	3U	2350	1.0	88.0	3U	2600	2.0	N	93.4	82.7	N				
												2	91.0	3U	2400	1.0												
												4	88.0	3U	2400	1.0												
25-17	KTVBY T52A3	F	N	9.2	Y	+18	+12	6000	74	29.42	30	3	L				L							N				
												2	L				L											
												4	L				L											

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

	VEHICLE DESCRIPTION												WEATHER			OCTANE NUMBER REQUIREMENT DATA										FUEL INFORMATION					
						SPARK ADVANCE										MAXIMUM				PART THROTTLE								RATER			
OBS NO	MODEL CODE	EMCT	ENGINE SERN	AIR C.R.	AIR RCD	AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	OCT NO	GEAR	RPM	MV	OCT NO	GEAR	RPM	MV	OWNK	OCT NO RES	OCT NO MOT	NITR	GTHR	GEAR	RPM	MV
08-23	KTVS3 P30A3	A	N	8.9	Y	+12	+12	11005	80	29.75	45	3	85.0	3U	2550	1.2	L						N				
												2	86.0	3U	2250	1.2											
												4	84.0	3U	2550	1.2											
25-06	KTVS3 P30A3	F	N	8.9	Y	+12	+12	6744	70	29.37	50	3	80.0	3U	3000	0.5	L						N				
												2	81.0	3U	3200	0.5											
												4	79.0	3U	3000	0.5											
46-10	KTVS3 P30A3	F	N	8.9	Y	+12		13608	74	29.40	83	3	80.0	3U	3050	1.2	L			N	96.0	87.1	N				
												2	80.0	3L	2450	1.2											
												4	L														
41-02	KITPFD 220M5	C	N	8.5	N			16340	70	29.90	70	3	85.0	4	3000	0.5	F			Y	91.9	82.2	B				
												2	86.0	4	3000	0.5											
												4	84.0	4	3000	0.5											
25-14	KITVAE 226M5	F	N	8.7	Y	+ 7	+ 7	6000	78	29.96		3	89.0	4	2000	0.0	90.0	5	2000	2.0			N				
												2	88.0	4	2400	0.0											
												4	89.0	5	1800	0.0											
63-03	MITPAD 220M5	F	N	8.5	N	+ 7	+ 7	10771	70	29.55	50	3	87.0	4	1500	1.0	87.0	4	1500	9.0			N				
												2	87.0	3	1600	1.0	90.0	4	1500	9.0							
												4	85.0	4	1500	1.0	F										
23-15	NTPCH T50A3	F	Y	H	9.2	N	0	0	6010	62	29.95	60	3	92.0	3	2400	1.2	89.0	3	2400	3.0	N			B	M	3U	2400	1.2
				H								2	95.0	2	3500	1.0											
				H								4	90.0	2	2200	1.0											
				L								3	89.0	3	2400	1.2											
				L								2	93.0	2	3500	1.0											
				L								4	89.0	2	2200	1.0											
23-17	NTPCH T50A4	F	Y	H	9.2	Y	0	0	7134	42	28.97	21	3	91.0	4L	1300	2.2	91.0	4L	1300	8.0	N			B	M	4L	1300	2.2
				H								2	93.0	2U	3200	1.0											
				H								4	89.0	4L	1300	2.2											
				L								3	86.0	4L	1300	2.2											
				L								2	88.0	2U	3200	1.0											
				L								4	85.0	4L	1300	2.2											
07-18	NTPCH T50A4	F	Y	H	9.2	Y	+ 8	+ 8	12282	67	30.16	53	3	90.0	3U	2050	1.0	89.0	3L	2100	8.0	N	92.1	82.2	N				
				H								2	89.0	3L	1750	2.5											
				H								4	88.5	2U	3100	1.1											
				L								3															
				L								2															
				L								4															

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

	VEHICLE DESCRIPTION								WEATHER			OCTANE NUMBER REQUIREMENT DATA								TANK FUEL INFORMATION							
						SPARK ADVANCE							MAXIMUM				PART THROTTLE					RATER				
OBS NO	MODEL CODE	EMCT	KNK SEN	C.R.	AIR	AS RCD	AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	OCT NO	GEAR	RPM	MV	OCT NO	GEAR	RPM	MV	OWKN E	OCT RES	NO MOT	INTT	GTHR	GEAR	RPM	MV
23-13	NTPCK T57A4	F	Y H	9.1	Y	0	0	7155	50	29.32	21	3	95.0	2U	3300	1.0	93.0	3U	2200	2.0	N			A	M	3U	2400	1.2
			H									2	98.0	2U	3500	1.0												
			H									4	93.0	3U	2200	1.2												
			L									3	95.0	2U	3300	1.0												
			L									2	97.0	2U	3500	1.0												
			L									4	93.0	3U	2200	1.2												
46-18	NTPCK T57A4	F	Y H	9.1	Y			8950	72	.	76	3	85.0	3U	2200	1.2	F				N	91.3	83.4	N				
			H									2	87.0	3U	2450	1.5												
			H									4	84.0	3U	2500	1.2												
			L									3	85.0	3U	2200	1.2	F											
			L									2	86.0	3U	2450	1.2												
			L									4	83.0	3U	2250	1.2												
41-30	NTPCK T57A4	F	Y H	9.1	Y	0	0	9155	68	30.07	65	3	97.0	4L	1800	2.0					N	96.1	87.0	B	M	4L	1800	2.0
			H									2	97.0	4L	1800	2.0												
			H									4	96.0	4L	1800	2.0												
			L									3	85.0	4L	1800	2.0												
			L									2	86.0	4L	1800	2.0												
			L									4	84.0	4L	1800	2.0												
47-25	NTPCK T57A4	C	Y H	9.1	Y	+ 2	0	6500	70	30.10	50	3	93.0	3U	3500	1.0	F											
			H									2	95.5	3U	3300	1.0												
			H									4	92.0	3U	2300	1.0												
			L									3	92.0	3U	3200	1.0												
			L									2	95.0	3U	3000	1.0												
			L									4	91.0	3U	2300	1.0												
41-20	NTPSR T28A4	C	Y H	8.9	Y	+10	+10	8901	67	30.00	66	3	98.0	4L	1800	1.5					N	92.0	83.1	B	M	4L	1800	1.5
			H									2	98.0	4L	1800	1.5												
			H									4	96.0	4L	1800	1.5												
			L									3	87.0	4L	1800	1.5												
			L									2	88.0	4L	1800	1.5												
			L									4	84.0	4L	1800	1.5												
23-25	NTPSR T28M4	F	Y H	8.9	Y	+10	+10	10367	45	29.98	28	3	91.0	4L	1500	0.8	91.0	4L	1500	2.0	N			N				
			H									2	91.0	4L	1500	0.8	91.0	4L	1500	4.0								
			H									4	91.0	4L	1500	0.8												
			L									3	88.0	4L	1500	0.8												
			L									2	87.0	4L	1500	0.8												
			L									4	86.0	4L	1500	0.8												

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMCT	KNK SEN	C.R.	SPARK ADVANCE AIR	SPARK ADVANCE RCD	SPARK ADVANCE TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OCTANE WKEN	RATER OCT NO RES	RATER OCT NO MOT	RATER INTN	RATER THR	RATER GEAR	RATER RPM	RATER MV
47-22	NTSGK T57A4	C	Y H	9.1	Y	0	0	6000	70	29.95	50	3	92.0	3U	2500	1.0	F											
			H									2	93.0	3U	2900	1.0												
			H									4	91.0	3U	2300	1.0												
			L									3	89.0	3U	2500	1.0												
			L									2	90.0	3U	2900	1.0												
			L									4	89.0	3U	2300	1.0												
23-14	NTSSE T25A4	F	N	8.3	Y	+ 8	+ 8	7070	50	29.52	22	3	92.0	4L	1900	1.2	92.0	3L	2500	5.0	N			B	M	4L	2100	1.2
												2	93.0	4L	2100	1.2												
												4	90.0	4L	1800	1.2												
23-18	NTSSR T28A4	F	Y H	8.9	Y	+ 6	+10	9744	56	29.03	60	3	92.0	3L	1600	1.4	92.0	4L	1500	2.0	N			B	M	4L	1300	1.4
			H									2	92.0	3L	1600	1.4												
			H									4	91.0	3L	1500	1.4												
			L									3	87.0	3L	1600	1.4												
			L									2	87.0	3L	1600	1.4												
			L									4	86.0	3L	1500	1.4												
05-23	NTSSR T28A4	F	Y H	8.9	Y	+10	+10	7027	69	30.00	50	3	97.0	4L	2000	1.4					N	95.7	84.7	A	M	4L	1800	1.4
			H									2	98.0	4L	2000	1.3												
			H									4	94.0	4L	1800	1.4												
			L									3	97.0	4L	2000	1.4												
			L									2	98.0	4L	2000	1.3												
			L									4	94.0	4L	1800	1.4												
23-22	NTSSZ T43A4	F	Y H	9.3	Y	0	0	8384	40	28.85	26	3	88.0	2U	2200	0.8	88.0	3U	2200	2.0	N			N				
			H									2	88.0	3U	2400	0.8												
			H									4	87.0	3U	2200	0.8												
			L									3	87.0	3U	2200	0.8												
			L									2	87.0	3U	2400	0.8												
			L									4	86.0	3U	2200	0.8												
46-12	NTSSZ T43A4	F	Y H	9.3	Y	0	0	10824	76	29.63	75	3	88.0	3L	1350	1.0	85.0	4L	1550	2.0	N	91.1	83.1	N				
			H									2	91.0	2U	1500	1.0												
			H									4	85.0	3L	1550	1.0												
			L									3	86.0	3L	1550	1.0												
			L									2	88.0	2U	2050	1.0												
			L									4	84.0	3L	1600	1.0												

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

	VEHICLE DESCRIPTION								WEATHER				OCTANE NUMBER REQUIREMENT DATA								TANK FUEL INFORMATION							
						SPARK ADVANCE							MAXIMUM				PART THROTTLE							RATER		
OBS NO	MODEL CODE	ENGINE CONT	ENGINE SENSOR	AIR C.R.	AIR SPARK ADV RCD	SPARK ADV TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL LEVEL	OCT NO	GEAR	RPM	MV	OCT NO	GEAR	RPM	MV	CWEN KR	OCT RES	OCT MOT	INTR	GRAD	RPM	MV
23-07	NTVGH T50A4	F	Y	H	9.2	Y	0	0	9959	68	29.43	58	3	91.0	2U	2600	0.8	88.0	3U	2400	2.0	N			B	M	2U	2600	0.8
				H									2	91.0	2U	2600	0.8											
				H									4	90.0	2U	2200	0.8											
				L									3	89.0	2U	2600	0.8											
				L									2	90.0	2U	2600	0.8											
				L									4	87.0	2U	2200	0.8											
23-16	NTVGH T50A4	F	Y	H	9.2	Y	0	0	7296	42	29.95	25	3	87.0	2U	2400	1.2	86.0	4L	1200	4.0	N			N				
				H									2	88.0	2U	2400	1.2											
				H									4	86.0	2U	2300	1.2											
				L									3	85.0	2U	2400	1.2											
				L									2	86.0	2U	2400	1.2											
				L									4	84.0	2U	2300	1.2											
28-12	NTVGH T50A4	F	Y	H	9.2	Y	0	0	10442	70	29.27	50	3	87.0	2U	2000	0.5	82.0	3U	1700	2.0				N				
				H									2	87.0	4L	1300	0.5											
				H									4	87.0	2U	2000	0.5											
				L									3	86.0	2U	2000	0.5	L										
				L									2	86.0	4L	1400	0.5											
				L									4	86.0	2U	2000	0.5											
46-19	NTVGZ T43A4	F	Y	H	9.3	Y	0	0	15699	75	29.60	62	3	88.0	3U	2600	1.0	84.0	4U	1475	2.5	N	92.8	83.5	N				
				H									2	91.0	2U	3150	1.0											
				H									4	88.0	3U	2450	1.0											
				L									3	86.0	3U	2400	1.0											
				L									2	86.0	2U	2950	1.0											
				L									4	85.0	3U	2625	1.0											
29-25	NTVGZ T43A4	F	Y	H	9.3	Y	0	0	26964	70	30.08	50	3	93.5	4L	1400	0.9	89.5	4L	1500	2.1	Y	92.4	82.8	A	M	4L	1300	0.9
				H									2	92.0	3U	2300	0.7											
				H									4	93.5	4L	1350	0.9											
				L									3	93.5	4L	1400	0.9											
				L									2	92.0	3U	2300	0.7											
				L									4	93.5	4L	1350	0.9											
23-06	NTVRE T57A4	F	Y	H	9.1	Y	0	0	8025	64	29.14	36	3	91.0	2U	2500	1.0	89.0	3U	2500	2.0	N			N				
				H									2	92.0	2U	2500	1.0											
				H									4	91.0	2U	2400	1.0											
				L									3	89.0	2U	2400	1.0											
				L									2	90.0	2U	2500	1.0											
				L									4	89.0	2U	2400	1.0											

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EM CT	KNK SEN	C.R.	SPARK ADVANCE AIR	SPARK ADVANCE ASRCD	SPARK ADVANCE TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OWKN	RATER OCT NO RES	RATER OCT NO MOT	RATER INTN	RATER INTR	RATER GEAR	RATER RPM	RATER MV
47-27	NTVRK T57M4	C	Y H	9.1	Y	+ 2	0	6700	70	30.22	50	3	81.0	3	1400	0.5	F											
			H									2	81.0	3	1500	0.5												
			H									4	81.0	3	2000	0.5												
			L									3	80.0	3	1400	0.5												
			L									2	80.0	3	1500	0.5												
			L									4	80.0	3	2000	0.5												
07-16	OTPFN P50A3	F	Y H	9.0	Y			9167	71	30.17	40	3	93.0	3	2300	1.0	92.0	3	1500	7.5	N	99.8	88.2	A	M	2	3700	1.0
			H									2	94.0	3	1450	1.3	93.0	3	1500	7.5								
			H									4	93.0	3	2400	1.0												
			L									3																
			L									2																
			L									4																
41-28	OTPFN P50A4	C	Y H	9.0	Y	+10	+10	10759	68	30.16	67	3	90.5	3	2800	1.0					N	97.6	86.4	B	M	3	2800	1.0
			H									2	92.0	3	2800	1.0												
			H									4	89.0	3	2800	1.0												
			L									3																
			L									2																
			L									4																
07-04	OTPFN P50M4	F	Y H	9.0	Y	+10	+10	6603	73	30.48	52	3	90.0	3	1600	0.2	90.0	4	1300	8.5	N	92.2	82.3	B	M	3	1600	0.2
			H									2	90.0	4	1500	0.2	88.0	4	1300	8.5								
			H									4	90.0	3	2000	0.2												
			L									3																
			L									2																
			L									4																
32-14	OTPFY P49M5	F	Y H	8.8	Y	+ 7	+10	13085	85	29.35	65	3	89.0	4	2900	0.4	88.0	4	2900	1.0	N							
			H									2	90.0	4	2950	0.4	90.0	4	2900	1.0								
			H									4	88.0	4	2800	0.4	88.0	4	2900	1.0								
			L									3	87.0	4	2900	0.4												
			L									2	88.0	4	2800	0.4												
			L									4	87.0	4	2900	0.4												
05-05	OTPFY P49M5	F	Y H	8.8	N	+10	+10	13190	69	30.02	50	3	89.0	3	1800	1.0					N	92.4	82.9	N				
			H									2	92.0	3	1800	1.0												
			H									4	89.0	3	1800	1.0												
			L									3	89.0	3	1800	1.0												
			L									2	91.0	3	1800	1.0												
			L									4	89.0	3	1800	1.0												

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMC T	KNK SEN	C.R.	SPARK ADVANCE A I R	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL L	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	TANK WEK	RATER OCT NO RES	RATER OCT NO MOT	RATER INT	RATER THR	RATER GEAR	RATER RPM	RATER MV
32-26	CTERA P23ME	F	N	9.5	Y	+12	+10	18131	85	29.47	65	3	88.0	4	3000	0.8	98.0	4	3350	2.0	Y							
												2	90.0	4	3000	0.8	90.0	4	3250	2.0								
												4	88.0	4	2400	0.8	88.0	4	2100	2.0								
46-08	CTERA P23ME	E	N	9.5	Y	+17	+10	19147	82	29.36	114	3	83.0	4	3200	1.0	81.5	4		2.0	N	95.5	96.1	N				
												2	86.0	3	3500	1.0												
												4	81.0	4		1.0												
32-16	CTPRT P29ME	F	N	9.0	Y	+10	+10	15368	85	29.45	69	3	91.0	4	1350	0.3	90.0	4	1350	2.0	N	92.1	92.2	B	M	4	1300	0.3
												2	91.0	4	1300	0.3	91.0	4	1300	2.0								
												4	91.0	4	1300	0.3	90.0	4	1300	2.0								
32-19	CTPRT P29ME	F	N	9.0	Y	+10	+10	30055	85	29.33	65	3	92.0	4	1400	0.1	91.0	4	1350	2.0	N	92.9	93.0	B	M	4	1500	0.1
												2	92.0	4	1400	0.1	92.0	4	1350	0.1								
												4	92.0	4	1350	0.1	91.0	4	1500	2.0								
06-13	CTPRT P29ME	F	N	9.0	Y	-10	-10	13665	74	29.90	73	3	95.0	4	1300	0.8	93.0	4	1300	3.0	N	94.4	88.6					
												2	94.0	4	1300	0.8												
												4	96.0	4	1300	0.8												
32-13	CTSAU P30A4	F	N	9.3	Y	+10	+10	16114	85	29.27	63	3	88.0	4L	2000	0.7	88.0	4L	1900	3.0	N	92.8	92.6	N				
												2	88.0	4L	2000	0.7	88.5	4L	2000	3.0								
												4	88.0	4L	2000	0.7	88.0	4L	1800	3.0								
32-19	CTSAU P30A4	F	N	9.3	Y	+10	+10	19374	85	29.14	65	3	88.0	4L	2100	1.1	88.0	4L	2000	3.0	N	92.6	93.0	N				
												2	88.0	4L	2200	1.1	88.0	4L	2200	3.0								
												4	88.0	4L	2150	1.1	88.0	4L	2050	3.0								
46-29	CTSAU P30A4	F	N	9.3	Y	+10	+10	11519	80	29.55	83	3	87.0	4U	2000	1.0	87.0	4U	2100	2.0	N	91.1	92.6	N				
												2	88.5	4U														
												4	86.5	4U														
32-21	CTSBN P59A4	F	Y	H	9.0	Y	+10	+10	17704	85	29.26	65	3	88.0	4	1100	2.6	98.0	4	1100	4.0	Y	92.1	92.8	N				
				H								2	88.0	4	1100	2.6	88.0	4	1100	4.0								
				H								4	87.0	4	1050	2.6	87.0	4	1050	4.0								
				L								3	88.0	4	1100	2.6	88.0	4	1100	4.0								
				L								2	88.0	4	1100	2.6	88.0	4	1100	4.0								
				L								4	87.0	4	1050	2.6	87.0	4	1050	4.0								
46-30	CTSBN P59A4	F	Y	H	9.0	Y	+10	+10	11174	49	29.96	38	3	86.0	4	1400	0.4	85.0	3	2900	1.4	N	95.0	93.1	N				
				H								2	87.0	3	3300	0.4												
				H								4	86.0	3	2950	0.4												
				L								3	86.0	4	1400	0.4												
				L								2	87.0	3	3300	0.4												
				L								4	85.0	3	2900	0.4												

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	FM CT	ENG SEN	AIR	SPARK ADVANCE RCD	SPARK ADVANCE TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	CWKN	RATER OCT NO RES	RATER OCT NO MOT	RATER INT	RATER THR	RATER GEAR	RATER RPM	RATER MV
65-26	OTSBT P29A4	F	N	Y	+10	+10	5850	46	29.88	26	3	91.5	4L	2150	0.0	90.0	4L	2000	1.5								
											2	92.5	3U	3400	0.0												
											4	89.5	3L	3150	0.0												
28-30	OTSBT P29A4	F	N	Y	+10	+10	10361	70	29.24	50	3	88.0	2U	3700	0.5	87.0	4L	1700	4.0				N				
											2	91.0	2U	3800	0.5												
											4	85.0	4L	1900	1.0												
65-25	OTSBT P29M4	F	N	Y	+10	+10	8250	44	29.55	34	3	93.0	4	1250	0.0	92.0	4	1150	1.5								
											2	93.5	4	1250	0.0												
											4	94.0	4	1300	0.0												
65-21	OTSBT P29M5	F	N	Y	+10	+10	15060	68	29.52	86	3	92.5	4	1400	0.0	92.5	4	1400	1.0								
											2	95.5	3	4100	0.0												
											4	94.5	4	1400	0.0												
05-24	OTSBT P29M5	F	N	Y	+10	+10	9080	70	30.40	28	3	94.0	4	1400	0.2	93.0	4	1300	4.0	N	93.0	81.0	A	P	4U	1100	4.0
											2	95.0	4	1300	0.2	95.0	4	1300	4.0								
											4	95.0	4	1350	0.2												
07-12	OTSBT P29M5	F	N	Y	+10	+ 8	8149	74	30.07	47	3	88.0	4	2300	0.3	85.0	4	1900	6.0	N	96.6	83.4	N				
											2	90.0	4	2150	0.3												
											4	88.0	4	2400	0.3												
41-27	OTSBT P29M5	C	N	Y	+10	+10	6541	72	30.00	68	3	92.0	3	5000	0.5	F				N	97.2	86.5	N				
											2	93.0	3	5000	0.5												
											4	90.5	3	5000	0.5												
32-29	OTSBT P49M5	F	Y	H	Y	+10	+10	12314	86	29.71	64	3	85.0	4	1050	0.4	84.5	4	1150	2.0	N	91.5	82.3	N				
				H							2	86.0	4	1150	0.5	85.0												
				H							4	84.0	4	1050	0.4	82.5												
				L							3	85.0	4	1050	0.4	84.5	4	1150	2.0								
				L							2	86.0	4	1150	0.5	85.0												
				L							4	84.0	4	1050	0.4	82.5												
41-25	OTSCG P58A3	C	N	Y	+10	+10	16108	66	30.20	68	3	97.0	3	1800	3.0	95.0	3	1800	4.0	Y	92.4	82.7	A	M	3	1800	3.0
											2	98.0	3	1800	3.0												
											4	97.0	3	1800	3.0												
28-10	OTSCN P50A3	F	Y	H	Y	+10	+10	10261	70	29.26	50	3	87.0	2U	2500	0.5	85.0	2U	2400	2.0				N				
				H							2	87.0	2U	2500	0.5												
				H							4	88.0	3U	2400	0.5												
				L							3	87.0	2U	2500	0.5	85.5	2U	2400	2.0								
				L							2	87.0	2U	2500	0.5												
				L							4	87.0	3U	2500	0.5												

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	BMC T	ENG SEN	C.R.	SPARK ADVANCE AIR	SPARK ADVANCE RCD	SPARK ADVANCE TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	COOLANT TEMP	RATER OCT NO RES	RATER OCT NO MOT	RATER INT	RATER THR	RATER GEAR	RATER RPM	RATER MV
06-08	OTVE7 P49A3	F	Y	8.8	Y	- 2	-10	22360	63	30.24	40	3	95.0	3	4100	1.0	98.0	3	4100	3.0								
			H									2	99.0	3	4100	1.0	101.0	3	4100	4.0								
			H									4	93.0	3	4100	1.0												
			L									3																
			L									2																
			L									4																
07-21	PTVS2 P30A3	F	N	8.9	Y			22923	70	29.92	55	3	85.0	2U	3200	0.9	84.0	3L	2000	7.5	N	92.2	82.2	B	P	3L	2200	7.5
												2	88.0	3U	2500	1.0	89.0	3L	2000	7.5								
												4	85.0	3U	2550	1.0												
06-29	PTVS3 P30A3	F	N	8.9	Y	+12	+12	6308	38	29.95	25	3	84.0	3L	2200	0.4	82.0	3L	2900	1.4	N	99.7	87.5	N				
												2	84.0	3L	2500	0.4												
												4	82.0	3U	3200	0.4												
65-11	PTVS3 P30A3	F	N	8.9	Y	+12	+12	19700	79	29.45	96	3	84.0	3L	2300	1.0												
												2	86.0	2U	2800	1.0												
												4	83.0	3U	2600	1.0												
47-15	PTVS3 P30A3	C	N	8.9	Y	+12	+12	9100	70	30.01	50	3	85.0	3L	2250	0.8	F											
												2	85.0	3L	2300	0.8												
												4	85.0	3L	2250	0.8												
29-15	PTVSK T25A3	F	N	9.0	Y			22188	70	30.05	54	3	85.5	2	3200	0.8	83.0	3	1950	2.0	N			N				
												2	87.0	3	2800	0.8												
												4	85.5	2	2150	0.8												
25-15	RTPJM P40A4	F	Y	9.2	Y			18600	70	29.90		3	86.0	4L	1400	2.5	87.0	4L	1400	3.5				B	M	3L	2000	1.3
			H									2	87.0	4L	1500	2.5												
			H									4	85.5	4L	1300	3.5												
			L									3	84.5	4L	1400	3.5	85.0	4L	1400	3.5								
			L									2	85.5	3U	2500	2.5												
			L									4	84.5	4L	1300	3.5												
41-31	RTPJM P40M5	C	Y	9.2	N			6571	72	30.06	68	3	96.0	3	2000	0.5	P				N	97.3	86.8	B	M	3	2000	0.5
			H									2	97.0	3	2000	0.5												
			H									4	95.0	3	2000	0.5												
			L									3	84.0	3	2000	0.5												
			L									2	85.0	3	2000	0.5												
			L									4	83.0	3	2000	0.5												

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMCT	ENGSEN	AIR	SPARK ADVANCE RCD	SPARK ADVANCE TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAX OCT NO	MAX GEAR	MAX RPM	MAX MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	GWKN	RATER OCT RES	RATER OCT MOT	RATER INTT	RATER HTR	RATER GEAR	RATER RPM	RATER MV
28-09	RTSAM P40A4	F	Y H	9.2	Y		10440	70	29.17	50	3	84.0	2U	2800	0.5								N				
			H								2	86.0	2U	2400	0.5												
			H								4	83.0	2U	2700	0.5												
			L								3	84.0	2U	2800	0.5												
			L								2	84.0	2U	2400	0.5												
			L								4	82.0	2U	2700	0.5												
06-05	RTSAM P40M5	F	Y H	9.2	N		17810	71	30.05	55	3	88.0	4	3200	0.4	85.0	4	3100	2.0	N	93.7	83.4	A	M	4	3200	0.4
			H								2	90.0	4	3200	0.4												
			H								4	86.0	4	3200	0.4												
			L								3	87.0	4	2800	0.4												
			L								2	87.0	4	3400	0.4												
			L								4	85.0	4	3200	0.4												
25-12	RTSJC 242M5	F	N	9.2	Y	+ 8	+ 8	10985	70	29.55		3	88.0	4	1600	0.0	89.0	5	1600	2.0	Y			N				
												2	90.0	4	1800	0.0												
												4	89.0	4	1800	0.0												
25-13	RTSJM P40A4	F	Y H	9.2	Y			14871	70	79.58		3	85.5	2U	2500	0.0	82.0	3U	2500	1.0								
			H									2	86.0	3U	2500	0.0												
			H									4	86.0	3L	1800	0.0												
			L									3	84.5	2U	3200	0.0												
			L									2	85.5	3U	2400	0.0												
			L									4	84.5	3L	1700	0.0												
46-03	SZTPA 213M5	F	N	8.9	Y	+10	+10	7429	70	29.30	84	3	86.0	4	2450	2.0	84.0	4	2450	3.0	N	95.1	85.2	N				
												2	87.0	4	2700	2.0												
												4	85.0	4	2500	2.0												
47-14	SZTPA 213M5	C	N	8.9	Y	+10	+10	8000	70	30.00	50	3	88.0	4	2000	2.0	P											
												2	89.0	4	2000	2.0												
												4	87.0	4	2000	2.0												
60-04	TTPIR 224M5	F	N	9.3	N	0	0	6546	76	29.46		3	90.0	4	1800	0.0	90.5	5	1300	3.5				B	M	4	1800	0.0
												2	89.0	4	2800	0.0	90.5	5		3.5								
												4	91.0	5	1600	0.0												
41-10	TTPIR P24A4	C	N	9.3	Y	+ 5	+ 5	11298	70	29.89	69	3	90.0	4	2200	1.5					N	91.4	83.0	N				
												2	91.0	4	2200	1.5												
												4	87.0	4	2200	1.5												
06-28	TTPIR P24M5	F	N	9.3	Y	+ 5	+ 5	8072	46	29.57	27	3	94.0	4	1600	0.4	94.0	4	2000	1.4	N	97.2	85.4	N				
												2	95.0	4	2000	0.4												
												4	95.0	4	1600	0.4												

1988 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	BMC T	KNK SEN	C.R.	AIR	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OWNK	RATER OCT NO RES	RATER OCT NO MOT	RATER INT	RATER THR	RATER GEAR	RATER RPM	RATER MV
05-16	TTPIR P24M5	F	N	9.3	Y	+ 5	+ 5	13832	70	29.80	28	3	95.0	4	3250	0.8	94.0	4	2600	3.5	N	91.3	80.7	B	M	4	2700	3.8
												2	97.0	3	3650	0.5												
												4	94.0	4	2200	9.8												
47-16	TTPIV P30M5	C	N	9.0	Y	+10	+10	8300	70	29.96	50	3	95.0	4	2700	0.0	94.0	4	2700	2.0								
												2	96.0	4	2700	0.0												
												4	92.0	4	2700	0.0												
50-19	TTVHY P22A4	F	N	8.8	Y			14221	75	29.67		3	95.0	3U	2500	1.0	95.0	4L	2400	3.0				A	M	4L	2400	1.0
												2	95.0	4L	2800	1.0												
												4	95.0	3U	2300	1.0												
05-26	ZTPA3 222M5	F	N	8.6	N	+ 6	+ 6	20385	68	30.42	50	3	90.0	4	1650	1.6					N	94.2	83.7	N				
												2	92.0	4	1800	1.6												
												4	88.0	4	1800	1.6												

APPENDIX F

PROCEDURES FOR CALCULATING AND PLOTTING OCTANE NUMBER REQUIREMENT DISTRIBUTION DATA

WEIGHTED VEHICLE POPULATIONS

Weighting factors for each model tested were proportioned to the productions and/or sales volumes developed from information supplied by U.S. vehicle manufacturers and from published information (Ward's Automotive Reports) for imports. The weighting factors of each vehicle model were divided by the number of vehicles tested within the model to calculate the individual vehicle weighting factor. The octane requirement for each vehicle were then arranged in increasing order. The percent of vehicles at each octane level is the summation of all vehicle weighting factors with octane requirements lower than that level, plus one-half the sum of the weighting factors at that level. The individual vehicle weighting factors are adjusted so that the summation of all vehicle weighting factors within the population of interest equals 100. Vehicle weighting factors for vehicles with octane requirements lower (L) than the lowest available fuel are assigned to beginning of the distribution while weighting factors for vehicles with octane requirements higher (H) than the highest test fuel are assigned above the highest test fuel octane level. For L and H octane requirements no octane value is used in the computation of octane satisfaction.

Octane satisfaction at population distribution points of interest is interpolated from the above distributions based on numeric octane data and an assumption of normal distribution between the two interprolation points.

DATA ROUND-OFF

The octane number requirements were rounded by the computer to one decimal place. All computations leading to the final rounded values were carried out at the full precision of the computer. In previous surveys the computer rounded requirement data to two decimal places. In preparing report tables the Analysis Panel rounded the computer decimal requirements to one decimal place.

In order to provide consistent treatment comparing 1988 and 1987 survey data, the 1987 data were recomputed and rounded to one decimal place by the computer. This can result in occasional small differences (e.g. $\pm$ 0.1) if a comparison is made using the data in the 1987 survey report.

SELECT CAR MODELS

For individual models, the octane number requirement distribution curves were plotted by the "Z" method as described in "Statistical Estimation of the Gasoline Octane Number Requirement of New Model Automobiles," C. S. Brinegar and R. R. Miller, Technometrics, Vol. 2, No. 1, February 1960.

The procedure is as follows:

For any vehicles having octane requirements lower (L) than the lowest octane number fuel available within a given fuel level, a number 0.5 Research/0.4 Motor lower was assigned. Similarly, for individual vehicles having octane requirements higher (H) than the highest octane fuel available within a given fuel series, a number 0.5 Research/0.4 Motor higher was assigned.

Using all observed and estimated octane number values, calculate the mean ($\bar{X}$) and the standard deviation (s) from the data for each model.

$$s = \left[\frac{1}{n-1} \sum_{i=1}^{n} (X_i - \bar{X})^2 \right]^{1/2}$$

Where X_i = Octane number requirement of i^{th} car of a given model

n = Number of cars of that model.

Estimate octane number requirements at the percentiles of interest from octane number requirement distribution data by

$$O.N. = \bar{X} + ks$$

Where k is selected from normal distribution tables.

Values of k used to calculate percentiles in this report are:

Percentile	k
5	-1.645
10	-1.282
20	-0.842
30	-0.524
40	-0.253
50	0
60	+0.253
70	+0.524
80	+0.842
90	+1.282
95	+1.645

APPENDIX G

CONFIDENCE LIMITS OF
OCTANE NUMBER REQUIREMENT DISTRIBUTIONS

CONFIDENCE LIMITS OF OCTANE NUMBER REQUIREMENT DISTRIBUTIONS

Octane number requirements of vehicles presented in this Survey are determined at the levels that satisfy certain percentages of specific vehicle populations. In many cases, the recorded octane number requirement is followed by a plus and minus limit, referred to as the confidence interval. These limits are expected to bound the true requirement of the population represented by the test vehicles 95 percent of the time in replicate testing of the same number of test vehicles.

At the 50 percent satisfaction level, the 95 percent confidence interval is calculated as follows:

$$CI = \pm ts/(n)^{1/2}$$

where t = Students t at the proper number of degrees of freedom*

s = Standard deviation, calculated directly from the data or estimated as the difference between the 84.16th and 50th percentiles (assuming normal distribution)

n = Number of vehicles in population.

At other satisfaction levels:

$$CI = \pm ts \quad 1/n + k^2/[2(n-1)]^{1/2}$$

At the 90 percent satisfaction level, k = 1.2817. For other satisfaction levels, appropriate values for k may be found in the standard statistical tables.

Degrees of Freedom**	t	Degrees of Freedom**	t
1	12.706	18	2.101
2	4.393	19	2.093
3	3.182	20	2.086
4	2.776	21	2.080
5	2.571	22	2.074
6	2.447	23	2.069
7	2.365	24	2.064
8	2.306	25	2.060
9	2.262	26	2.056
10	2.228	27	2.052
11	2.201	28	2.048
12	2.179	29	2.045
13	2.160	30	2.042
14	2.145	40	2.021
15	2.131	60	2.000
16	2.120	120	1.980
17	2.110		1.960

* Distribution of t for probability = 0.05.
** Degrees of Freedom = (n-1).

TABLE G-I

95% CONFIDENCE LIMITS FOR MAXIMUM OCTANE NUMBER REQUIREMENTS

1988 Weighted Population Groups

Population	Fuel	No. Veh.	t	Standard Dev. RON	Standard Dev. MON	Standard Dev. (R+M)/2	95% Confidence Limits RON 50%	RON 90%	MON 50%	MON 90%	(R+M)/2 50%	(R+M)/2 90%
Total Vehicles												
Includes Knock Sensor	PR	390	1.966	4.38	4.38	4.38	0.44	0.59	0.44	0.59	0.44	0.59
Maximum (High-Borderline)	FBRU	391	1.966	4.55	2.86	3.70	0.45	0.61	0.28	0.38	0.36	0.49
Requirements	FBRSU	391	1.966	4.90	3.43	4.16	0.49	0.66	0.34	0.46	0.41	0.56
Includes Knock Sensor	PR	376	1.966	4.24	4.24	4.24	0.43	0.58	0.43	0.58	0.43	0.58
Minimum (Low-Borderline)	FBRU	377	1.966	4.56	2.90	3.73	0.46	0.62	0.29	0.40	0.37	0.51
Requirements	FBRSU	376	1.966	4.75	3.23	3.99	0.48	0.65	0.33	0.44	0.40	0.54
Passenger Cars												
Includes Knock Sensor	PR	304	1.968	4.41	4.41	4.41	0.50	0.67	0.50	0.67	0.50	0.67
Maximum (High-Borderline)	FBRU	305	1.968	4.60	2.90	3.75	0.52	0.70	0.33	0.44	0.42	0.57
Requirements	FBRSU	305	1.968	5.24	3.68	4.46	0.59	0.80	0.41	0.56	0.50	0.68
Includes Knock Sensor	PR	295	1.968	4.30	4.30	4.30	0.49	0.67	0.49	0.67	0.49	0.67
Minimum (Low-Borderline)	FBRU	296	1.968	4.48	2.85	3.66	0.51	0.69	0.33	0.44	0.42	0.56
Requirements	FBRSU	295	1.968	4.97	3.42	4.19	0.57	0.77	0.39	0.53	0.48	0.65
Light-Duty Trucks & Vans												
Includes Knock Sensor	PR	86	1.987	4.66	4.66	4.66	1.00	1.35	1.00	1.35	1.00	1.35
Maximum (High-Borderline)	FBRU	86	1.987	4.46	2.80	3.63	0.96	1.29	0.60	0.81	0.78	1.05
Requirements	FBRSU	86	1.987	3.70	2.51	3.10	0.79	1.07	0.54	0.73	0.66	0.90
Includes Knock Sensor	PR	81	1.989	4.04	4.04	4.04	0.89	1.21	0.89	1.21	0.89	1.21
Minimum (Low-Borderline)	FBRU	81	1.989	4.62	2.95	3.78	1.02	1.38	0.65	0.88	0.83	1.13
Requirements	FBRSU	81	1.989	4.29	2.92	3.60	0.95	1.28	0.65	0.87	0.80	1.07

TABLE G-I
(Continued)

95% CONFIDENCE LIMITS FOR MAXIMUM OCTANE NUMBER REQUIREMENTS

1988 Weighted Population Groups

Population	Fuel	No. Veh.	t	Standard Dev.			95% Confidence Limits					
							RON		MON		(R+M)/2	
				RON	MON	(R+M)/2	50%	90%	50%	90%	50%	90%
Total Knock-Sensor Vehicles												
Includes Knock Sensor	PR	155	1.976	4.77	4.77	4.77	0.76	1.02	0.76	1.02	0.76	1.02
Maximum (High-Borderline)	FBRU	155	1.976	5.22	3.26	4.24	0.83	1.12	0.52	0.70	0.67	0.91
Requirements	FBRSU	155	1.976	4.83	3.44	4.13	0.77	1.04	0.55	0.74	0.66	0.89
Includes Knock Sensor	PR	141	1.977	5.19	5.19	5.19	0.86	1.17	0.86	1.17	0.86	1.17
Minimum (Low-Borderline)	FBRU	141	1.977	5.50	3.56	4.53	0.92	1.24	0.59	0.80	0.75	1.02
Requirements	FBRSU	140	1.977	5.33	3.64	4.48	0.89	1.20	0.61	0.82	0.75	1.01

TABLE G-II

95% CONFIDENCE LIMITS FOR MAXIMUM (R+M)/2, RON, AND MON REQUIREMENTS

1988 Select Models

Model	Fuel	n	t	Std.Dev. (s) (R+M)/2	95% Confidence Limits, (R+M)/2 50% Satis.	95% Confidence Limits, (R+M)/2 90% Satis.	Std.Dev. (s) RON	95% Confidence Limits, RON 50% Satis.	95% Confidence Limits, RON 90% Satis.	Std.Dev. (s) MON	95% Confidence Limits, MON 50% Satis.	95% Confidence Limits, MON 90% Satis.
NAR T25A3/HAR T25A3	PR	18	2.11	4.1	2.0	2.8	4.1	2.0	2.8	4.1	2.0	2.8
IAR T25A3/LAR T25A3	FBRU	18	2.11	4.2	2.1	2.8	4.8	2.4	3.3	3.6	1.8	2.4
	FBRSU	18	2.11	4.0	2.0	2.7	4.4	2.2	3.0	3.5	1.7	2.4
NAW P28A3/NLW P28A3	PR	17	2.12	5.3	2.7	3.7	5.3	2.7	3.7	5.3	2.7	3.7
HAW P28A3/IAW P28A3	FBRU	17	2.12	4.2	2.2	3.0	5.1	2.6	3.6	3.4	1.7	2.4
LAW P28A3 (High Borderline)	FBRSU	17	2.12	4.4	2.2	3.1	5.1	2.6	3.6	3.6	1.9	2.6
NAW P28A3/NLW P28A3	PR	17	2.12	4.1	2.1	2.9	4.1	2.1	2.9	4.1	2.1	2.9
HAW P28A3/IAW P28A3	FBRU	17	2.12	3.8	2.0	2.7	4.6	2.4	3.2	3.1	1.6	2.2
LAW P28A3 (Low Borderline)	FBRSU	17	2.12	4.1	2.1	2.9	4.9	2.5	3.4	3.4	1.8	2.4
NAW P28A4/HWW P28A4	PR	19	2.10	4.6	2.2	3.0	4.6	2.2	3.0	4.6	2.2	3.0
IWW P28A4/LAW P28A4	FBRU	19	2.10	4.4	2.1	2.9	5.3	2.6	3.5	3.5	1.7	2.3
LWW P28A4 (High Borderline)	FBRSU	19	2.10	4.7	2.3	3.1	5.5	2.7	3.7	3.9	1.9	2.5
NAW P28A4/HWW P28A4	PR	18	2.11	3.8	1.9	2.6	3.8	1.9	2.6	3.8	1.9	2.6
IWW P28A4/LAW P28A4	FBRU	18	2.11	2.9	1.5	2.0	3.5	1.7	2.4	2.4	1.2	1.6
LWW P28A4 (Low Borderline)	FBRSU	18	2.11	3.3	1.6	2.2	3.9	1.9	2.6	2.6	1.3	1.8
HHC P38A4/ICC P38A4	PR	13	2.18	3.4	2.1	2.8	3.4	2.1	2.8	3.4	2.1	2.8
IHC P38A4/LHC P38A4	FBRU	13	2.18	3.4	2.1	2.8	4.1	2.5	3.4	2.7	1.6	2.3
(High Borderline)	FBRSU	13	2.18	3.9	2.3	3.2	4.6	2.8	3.8	3.2	1.9	2.6
HHC P38A4/ICC P38A4	PR	13	2.18	3.1	1.9	2.6	3.1	1.9	2.6	3.1	1.9	2.6
IHC P38A4/LHC P38A4	FBRU	13	2.18	2.7	1.6	2.2	3.2	1.9	2.6	2.1	1.3	1.8
(Low Borderline)	FBRSU	13	2.18	3.3	2.1	2.9	3.9	2.5	3.4	2.7	1.7	2.4

TABLE G-II
(Continued)

95% CONFIDENCE LIMITS FOR MAXIMUM (R+M)/2, RON, AND MON REQUIREMENTS

1988 Select Models

Model	Fuel	n	t	Std.Dev. (s) (R+M)/2	95% Confidence Limits, (R+M)/2 50% Satis.	95% Confidence Limits, (R+M)/2 90% Satis.	Std.Dev. (s) RON	95% Confidence Limits, RON 50% Satis.	95% Confidence Limits, RON 90% Satis.	Std.Dev. (s) MON	95% Confidence Limits, MON 50% Satis.	95% Confidence Limits, MON 90% Satis.
MC5 P16A3	PR	11	2.23	3.7	2.5	3.4	3.7	2.5	3.4	3.7	2.5	3.4
	FBRU	11	2.23	3.1	2.1	2.8	3.7	2.5	3.4	2.4	1.6	2.3
	FBRSU	11	2.23	3.0	2.0	2.7	3.5	2.4	3.3	2.4	1.6	2.2
ODU P30A4/MDU P30A4 (High Borderline)	PR	18	2.11	2.8	1.4	1.9	2.8	1.4	1.9	2.8	1.4	1.9
	FBRU	18	2.11	2.8	1.4	1.9	3.4	1.7	2.3	2.2	1.1	1.5
	FBRSU	18	2.11	3.1	1.5	2.1	3.6	1.8	2.4	2.6	1.3	1.8
ODU P30A4/MDU P30A4 (Low borderline)	PR	15	2.14	3.8	2.1	2.9	3.8	2.1	2.9	3.8	2.1	2.9
	FBRU	16	2.13	3.4	1.8	2.5	4.1	2.2	3.0	2.7	1.4	2.0
	FBRSU	16	2.13	3.7	2.0	2.7	4.4	2.3	3.2	3.1	1.7	2.3
OPF P50A4/OSF P50A4 MPF P50A4/SPF P50A4	PR	12	2.20	3.0	1.9	2.7	3.0	1.9	2.7	3.0	1.9	2.7
	FBRU	12	2.20	2.9	1.8	2.5	3.4	2.2	3.0	2.3	1.4	2.0
	FBRSU	12	2.20	2.9	1.9	2.5	3.4	2.2	3.0	2.4	1.5	2.1
PKD T22A3/PPD T22A3 KPD T22A3	PR	11	2.23	1.7	1.2	1.6	1.7	1.2	1.6	1.7	1.2	1.6
	FBRU	11	2.23	1.9	1.3	1.7	2.3	1.5	2.1	1.5	1.0	1.4
	FBRSU	11	2.23	2.1	1.4	1.9	2.5	1.7	2.3	1.7	1.1	1.5