

Technical Support Report for Regulatory Action
(INTERIM REPORT)

Selection of Transient Cycles for
Heavy-Duty Engines

Tad Wysor
and
Chester France

November 1977

Notice

Technical support reports for regulatory action do not necessarily represent the final EPA decision on regulatory issues. They are intended to present a technical analysis of an issue and recommendations resulting from the assumptions and constraints of that analysis. Agency policy considerations or data received subsequent to the date of release of this report may alter the conclusions reached. Readers are cautioned to seek the latest analysis from EPA before using the information contained herein.

Standards Development and Support Branch
Emission Control Technology Division
Office of Mobile Source Air Pollution Control
Office of Air and Waste Management
U.S. Environmental Protection Agency

Foreword

This report presents summary statistics of those candidate cycles generated by computer to be representative of the CAPE-21 data base and selects one cycle for each category that is most representative. The selections are based solely upon statistical considerations. Further evaluations of the candidate cycles must still be made in terms of the practical aspects of running the cycles on the dynamometer, and in terms of their physical representativeness of real operation. The cycles identified herein are being used by EPA as a basis for developing its test facilities. This report is being released at this time in response to numerous requests by organizations considering the development of transient test facilities to give an indication of the types of cycles that are expected to be used in future certification procedures.

This report has been labelled as an "interim" report to emphasize the tentative nature of the selected cycles. As indicated above, EPA plans further evaluation of the cycles. Along these lines, one problem has already been identified with the New York non-freeway cycle for gasoline engines. It has been shown that this cycle has excessive high speed (RPM) operation. The problem has been attributed to one truck contributing bad data to the input data base rather than to the computer cycle generation procedure. An addendum has been attached to this report which addresses this specific problem and provides a recommended solution. EPA has not made a final determination regarding this "problem" cycle.

Selection of Transient Cycles for Heavy-Duty Engines

Summary

As a product of the heavy-duty engine cycle development effort, computer-generated engine cycles have been provided by Olson Labs. Out of three candidate cycles in each of 8 truck categories, one cycle from each category was chosen as the most representative of the actual truck data. Using the cycle's summary statistics calculated by Olson and the power and RPM density functions, the cycles in each category were scored. Table 1 lists the selected five-minute cycles by their designated random numbers. A second-by-second listing for each of these selected cycles is included in Appendix B.

Table 1

<u>Category</u>			<u>Cycle</u>
LA	Gas	Non-Freeway	203887989
	Gas	Freeway	296644805
	Diesel	Non-Freeway	2110248101
	Diesel	Freeway	1599345415
NY	Gas	Non-Freeway	8410263
	Gas	Freeway	792043535
	Diesel	Non-Freeway	2114147447
	Diesel	Freeway	104099549

Background and Introduction

Since the CAPE-21 truck-usage data has become available, there has been an effort to generate computer cycles which simulate the real-life driving patterns. CAPE-21 refers to an EPA project which was conducted as a means of acquiring an accurate picture of actual urban truck operation. In each of the cities of Los Angeles and New York, forty-four in use trucks (plus 3 buses in Los Angeles and 4 in New York) were instrumented to record vehicle and engine data on an approximately second-by-second basis. The parameters of interest were vehicle speed, engine speed, road and traffic conditions, and a load parameter (i.e., a measure of power, such as manifold vacuum or rack position). With this compiled information as a basis, an attempt has been made to synthesize -- via computer -- cycles of relatively short duration which simulate the operating characteristics of the total real-life sample. The intent is to make possible in-lab testing which is indeed representative of on-the-road operation.

Olson Laboratories has provided candidate cycles -- both chassis and engine cycles -- produced from the New York and Los Angeles data. The selection of the engine cycles is the concern of this particular report.

Twenty-four computer-generated 5-minute engine cycles were provided, three in each of the following eight road categories:

<u>Los Angeles</u>	Gas	Non-Freeway
	Gas	Freeway
	Diesel	Non-Freeway
	Diesel	Freeway
<u>New York</u>	Gas	Non-Freeway
	Gas	Freeway
	Diesel	Non-Freeway
	Diesel	Freeway

Although numerous cycles were generated, only a few passed the screening criteria developed by Malcolm Smith of Olson. He selected from these the best three in each category and submitted them as the candidate cycles. It was necessary for EPA to choose one candidate cycle for each category.

The primary way by which the cycles were compared and rated was with the Kolgomorov-Smirnov one-sample test, hereafter abbreviated "K-S test". The K-S test is a non-parametric statistical test concerned with the degree of agreement between two distributions. It determines whether two distributions can reasonably be thought to have come from the same population. Specifically, the candidate cycle cumulative distributions are compared to the CAPE-21 cumulative distribution (assumed to be the theoretical distributions). When compared on an increment-by-increment basis, there will occur at some point a maximum difference D between the two distributions. D can be related to a level of significance, α , which depends on the size of the sample. If the maximum difference D exceeds the critical difference for that sample size at a particular significance level (α), then the sample does not pass the K-S test and it must be assumed that the two distributions are dissimilar. Table 2 relates sample size to significance levels and critical differences.

Table 2*

Sample Size (N)	Significance Level α				
	.20	.15	.10	.05	.01
Over 35	<u>1.07</u>	<u>1.14</u>	<u>1.22</u>	<u>1.36</u>	<u>1.63</u>
	$\sqrt{N}$	$\sqrt{N}$	$\sqrt{N}$	$\sqrt{N}$	$\sqrt{N}$

The computed values are the critical differences for a particular N. The smallest critical difference which exceeds the maximum difference D for the test yields the significance level.

* from Nonparametric Statistics, Sidney Siegel, McGraw-Hill, NY, 1956.

In digression, the significance level is the probability of rejecting a true hypothesis when it is actually true. In relation to the K-S test, significance level is the probability of not accepting two distributions as being the same, when in reality they are. This type of error is acceptable when comparing two cumulative distributions. Therefore, it is desirable to have a large significance level, since this results in more assurance that the two distributions being compared are really the same. For most engineering and statistical applications, significance levels of .05 or .10 are adequate.

Each cycle was compared with the input data in two ways by means of K-S tests (as detailed below). In this manner the acceptability of the particular cycle could be rated.

Selection Procedure

The procedure for selecting a best of the three candidates in each truck category involved ranking the cycles according to three main criteria: 1) The overall summary statistics for each cycle, 2) the agreement of the distribution functions (for power and RPM) with the input data, as screened by the K-S test, and 3) a visual rating of the density plots. In most cases a clear choice for each category could be made according to these criteria.

A table of Summary Statistics was provided by Olson for each candidate cycle; they reflect several ways in which the cycle parameters were compared to those of the input. Olson was able to compile the massive road data into a matrix relating observed initial and final values for both engine speed and power. It is from this matrix that the numerous cycles were generated (out of which the three best cycles in each category were "filtered"). The cycles themselves were, for testing purposes, converted to initial/final RPM and power matrices, and various portions of the matrix were tested for similarity with the corresponding portions of the input matrix.

The screening test was accomplished by arranging the rows of several sectors of both the cycle matrix and the input matrix into cumulative distribution functions. The K-S test as described above could then be applied to the distributions, and the summary statistics present the significance levels at which the cycle passed (or failed). Table 3 shows that tests were done on the matrix as a whole, on the diagonal of the matrix, and on the upper and lower portions (above and below the diagonal).

It can also be seen from Table 3 that several other parameters were tabulated in the statistics -- for the input as well as for each candidate cycle. The fraction of occurrence which the cycle matrix exhibits in the upper, lower, diagonal (less idle), and idle (RPM and power both equal zero) portions are tabulated in the "CYCLE PERCENTAGES" column of Table 3. Also, the percentages of the cycle that the engine speed or

KEY TO TABLES 3 AND 4

K-S Significance Levels:	M	Total Matrix
	D	Matrix Diagonal
	V	Portion Above Diag. (upper)
	L	Portion Below Diag. (lower)
RPM and Power Percentages:	A	Percent Acceleration
	D	Percent Deceleration
	C	Percent Cruise
	Z	Percent Zero
	M	Percent Motoring (power only)

TABLE 3

LA	Significance Level				Cycle Percentages				Mean RPM	RPM Percentages				Mean Power	Power Percentages				
	M	D	U	L	U	L	D	Idle		A	D	C	Z		A	D	C	M	Z
GAS Input					31	28	16	25	26	25	22	24	29	31	16	18	24	14	29
NON 85063489	.14	.22	.20	.47	35	24	18	23	27	31	18	26	25	38	16	19	36	6	24
FWY 2038877989	.15	.74	.94	.32	31	29	14	26	27	27	23	22	29	33	15	18	29	11	27
2113161687	.11	.45	.83	.93	28	28	16	29	24	21	21	23	36	32	16	18	23	14	29
GAS Input					29	29	40	2	63	19	18	60	3	63	17	18	55	7	3
FWY 1256706477	.01	.15	.01	.15	30	30	38	2	61	24	23	51	2	75	15	15	59	8	4
1223400511	.01	.01	.20	.05	32	28	38	2	64	23	19	57	2	67	21	18	49	8	3
296644805	.20	.15	.20	.20	28	28	41	2	64	22	16	60	2	68	14	18	59	7	2
DSL Input					30	26	10	35	43	26	22	14	38	22	14	15	13	22	35
NON 2110248101	.80	1.0	.55	.22	28	29	10	34	43	26	24	13	37	26	12	14	18	21	34
FWY 2124416999	.13	.39	.50	.13	29	29	10	31	45	27	27	13	33	21	13	14	12	31	31
279615	.10	.93	.26	.39	28	28	9	34	45	25	27	14	35	20	15	15	16	21	34
DSL Input					36	35	27	2	84	26	24	48	2	54	22	22	38	16	3
FWY 1599345415	.43	.17	.76	.59	37	36	24	2.3	83	27	25	46	2	56	22	23	41	12	3
1109958927	.14	.15	.75	.56	34	29	35	2.2	83	25	26	48	2	64	20	18	44	15	3 ¹
1041454501	.16	.38	.42	.58	37	26	35	2.3	82	26	28	44	3	51	22	18	42	14	3 ¹
NY																			
GAS Input					23	23	14	40	13	18	17	17	47	19	14	14	14	16	42
NON 8410263	.41	.72	.35	.65	23	22	12	41	12	19	17	10	54	20	14	16	12	17	42
FWY 2189178847	.13	.67	.12	.61	26	18	9	46	13	20	13	14	53	16	13	15	12	12	48
2140599455	.18	.55	.20	.24	20	21	10	49	13	16	18	14	52	16	11	10	11	17	51
GAS Input					33	31	26	10	48	23	21	45	12	50	19	20	32	18	11
FWY 792043535	.13	.72	.57	.43	33	31	24	12	50	25	17	46	12	48	18	24	31	13	13
229633293	.036	.61	.14	.098	31	37	22	10	50	23	29	38	10	48	19	20	25	25	11
202045271	.087	.21	.59	.27	32	31	26	11	50	28	24	36	11	58	16	17	34	21	11
DSL Input					21	21	7	51	20	17	16	8	58	16	13	12	12	11	51
NON 2114147447	.35	.99	.13	.41	19	21	6	55	20	14	15	8	63	16	12	12	14	8	55
FWY 5618007	.28	.42	.81	.53	19	21	6	53	19	15	17	6	63	14	12	11	10	14	54
2145368549	.18	1.0	.13	.12	23	22	8	48	19	19	17	5	58	19	12	12	15	12	48
DSL Input					32	32	17	19	53	25	25	25	24	42	17	17	26	20	20
FWY 81204277	.15	.16	.06	.15	35	31	12	22	54	28	24	23	25	48	20	20	30	8	23
76964269	.42	.43	.56	.54	31	25	22	22	53	25	20	30	25	50	12	15	29	21	23
104099549	.32	.09	.35	.22	32	31	12	25	52	26	23	23	28	41	18	16	26	14	26

TABLE 4

LA	Significance Level				Cycle Percentages				Mean RPM	RPM Percentages				Mean Power	Power Percentages					Total Scores	Overall Ranking
	M	D	U	L	U	L	D	Idle		A	D	C	Z		A	D	C	M	Z		
GAS 85063489	2	3	3	2	2	3	2	2	1	3	2	2	2	3	1	2	3	3	3	44	3
NON 2038877989	1	1	1	3	1	2	2	1	1	1	1	2	1	2	2	1	2	2	2	29	1
FWY 2113161687	3	2	2	1	3	1	1	3	2	2	1	1	3	1	1	1	1	1	1	31	2
GAS 1256706477	2	1	2	2	1	1	2	1	2	3	3	3	1	3	1	3	1	2	2	44	3
FWY 1223400511	2	2	1	3	2	1	2	1	1	2	1	2	1	1	3	2	2	2	1	41	2
296655805	1	1	1	1	1	1	1	1	1	1	2	1	1	2	2	1	1	1	2	27	1
DSL 2110248101	1	1	1	2	2	2	1	1	1	1	1	2	1	3	2	2	3	1	1	29	1
NON 2124416999	2	3	2	3	1	2	1	2	2	2	2	2	3	1	1	2	1	2	2	36	3
FWY 279615	3	2	3	1	2	1	2	1	2	2	2	1	2	2	1	1	2	1	1	32	2
DSL 1599345415	1	2	1	1	1	1	1	2	1	2	1	2	1	1	1	1	1	3	1	25	1
FWY 1109958927	3	3	2	3	2	2	2	1	1	2	2	1	1	3	2	2	3	1	1	37	2
1091454501	2	1	3	2	1	3	2	2	2	1	3	3	2	2	1	2	2	2	1	37	2
NY																					
GAS 8410263	1	1	1	1	1	1	1	1	2	1	1	2	3	1	1	2	1	1	1	24	1
NON 2109178847	3	2	3	2	2	3	3	2	3	2	3	1	2	3	2	1	1	2	2	42	3
FWY 2140599455	2	3	2	3	2	2	2	3	1	2	2	1	1	2	3	3	2	1	3	40	2
GAS 792043535	1	1	2	1	1	1	2	3	1	2	2	1	1	1	2	3	1	2	2	30	1
FWY 229633293	3	2	3	3	3	2	3	1	1	1	3	2	3	1	1	1	3	3	1	40	3
202045271	2	3	1	2	2	1	1	2	1	3	1	3	2	2	3	2	2	1	1	35	2
DSL 2114147447	1	2	2	2	1	1	2	3	1	2	1	1	2	1	1	1	1	2	2	29	2
NON 5618007	2	3	1	1	1	1	1	1	2	1	1	2	2	2	1	2	1	2	1	28	1
FWY 2145368549	3	1	2	3	1	2	2	2	2	1	1	3	1	3	1	1	2	1	1	33	3
DSL 81204277	3	2	3	3	3	1	1	1	2	3	1	1	1	2	2	3	3	3	1	39	3
FWY 76964269	1	1	1	1	2	2	1	1	1	1	3	2	1	3	3	2	2	1	1	30	1
104099549	2	3	2	2	1	1	1	2	2	2	2	1	2	1	1	1	1	2	2	31	2

power was increasing (ACCEL.), decreasing (DECEL.), remaining constant (CRUISE), or at zero percent of its absolute reference (ZERO) appear under the RPM- and POWER PERCENTAGES. It will be noted that a fifth parameter is included under the POWER PERCENTAGES -- "motoring" occurs when the engine is producing negative power (when coasting downhill against the engine, for example). Finally, the mean RPM and Power are tabulated. The summary statistics, then, present the characteristics of the cycle which the generation process was designed to key upon. It is expected that a reasonable correlation would exist in these areas with respect to the input data (as is indeed the case).

Returning to the selection procedure, the candidates were ranked according to their summary statistics. Table 4 gives the 1-2-3 scoring that was given each cycle for each of the parameters of Table 3 (1 = best, 3 = worst). The highest significance levels were ranked first, whereas the other parameters were compared to input values with the closest match scoring highest. The total scores for the cycles reflect a general ranking within each category; the cycle scoring the fewest points will be favored over the other contenders in this aspect of the selection process, as reflected by the final rankings for each category. This does not necessarily mean the best overall cycle is picked, but certainly some indication of how well the cycle fared with regard to these particular parameters is obtained. This scoring procedure is not flawless -- all parameters are weighted equally, for example -- so a cycle which scores a close second could be easily chosen if other selection criteria favor it.

As a second criterion on which to base the selection of the cycles, a K-S test was performed on the cumulative distribution functions. This was a way of getting a feel for the quality of the RPM and power density functions, considered important because percent operation at, say, full power or at a certain engine speed can dramatically influence emissions. The RPM density functions were plotted in increments of 6% and those for power in increments of 10%*. By summing the frequency percentages incrementally, the cumulative distributions were produced. Then these cycle distributions could be compared increment-by-increment with the respective input distributions (derived for the same increments). The result of this process was a K-S significance level for both the RPM and power distribution functions for each cycle. Hence another means of ranking the three candidates in each category was provided. Table 5 presents the K-S results and a general scoring within each category; a sample K-S test is included in Appendix A. Again, the higher the significance level the better.

It may be unclear exactly why a cycle can score well on Olson's K-S criteria and yet display a poor density function. One reason is simply that the generation process was not designed to simulate the density function -- just the initial/final matrix. Also, the length of

* % RPM is defined here as $\frac{\text{RPM} - \text{RPM) Idle}}{\text{RPM)rated} - \text{RPM)idle}}$.

% Power is the percent of the maximum power at the RPM in question.

Table 5

				K-S Significance Level		
<u>Category</u>			<u>Cycle</u>	<u>RPM</u>	<u>POWER</u>	<u>Ranking</u>
LA	Gas	Non-Freeway	850-	.20	--	3
			203-	.20	.20	1
			2113-	.10	.20	2
		Freeway	296-	.20	--	2
			125-	.01	--	3
			122-	.01	.01	1
	Diesel	Non-Freeway	2110-	.20	.20	1
			212-	.10	.01	3
			279-	.15	.20	2
		Freeway	159-	.20	.01	2
			109-	.15	.20	1
			110-	.20	--	3
NY	Gas	Non-Freeway	841-	.20	.20	1
			210-	.20	.01	2
			214-	.20	--	3
		Freeway	792-	.15	.10	1
			229-	.01	--	2
			202-	.01	--	2
	Diesel	Non-Freeway	2114-	.20	.20	1
			2145-	.20	.20	1
			561-	.20	.10	2
		Freeway	812-	.20	--	2
			769-	.20	--	2
			104-	.20	.15	1

-- indicates cycle did not pass at .01 level.

the 5-minute cycles is sufficiently short that it is difficult for the computer to sample the entire population (as represented by the input matrix), and this may also affect the frequency of occurrence of various RPM and power values. However, since the generation process tends toward cycles with good mean RPM and power correlation with the input (See Table 3), there is reason to expect that, for the most part, the generated cycles will have reasonable density functions (and this is generally the case).

The third criterion by which the cycles were rated was simply a visual comparison of the power and RPM density plots for the various candidates to their respective input density plots. Agreement with the input depended on the general shape of the density function and the location of the peaks and valleys. Because of its obvious lack of precision, this factor in the selection process was generally weighted less heavily than the other two. Again the cycles in each category have been given a ranking (Table 6) according to this visual test. It must be clarified here that a numerical ranking in this case is of only limited significance. The two previous selection criteria have at least a partial quantitative value; the scoring by visual inspection of the density plots, however, is necessarily more subjective. The reader is warned against assuming that the 1-2-3 scoring implies some rigid numerical significance in this third phase of the selection procedure. (For the sake of reference, the power and RPM density functions for the selected cycles as presented in Figures 1-16; the remaining plots are found in Appendix C.)

Table 7 is a summary of the rankings of each candidate cycle based on each of the three criteria as well as a final ranking within each category. Again, the ranking is only a qualitative gauge of the cycles' quality since the relative weighting of each criterion is not reflected. The verbal discussion of the cycle selections presented below gives a clearer view of the factors involved in each decision.

Discussion

What follows is a brief rationale for each cycle selection. The chosen cycles, which are listed in Table 1, are denoted by the first three digits of their random number. The summary statistics (Tables 3 and 4), the K-S results (Table 5), and the density functions (Figures 1 - 16 and Appendix C) should be helpful.

LA Gas Non-Freeway: Cycle 203- has the best statistics, of the candidates for this category, but cycle 211- is a close second. The deciding factor was the K-S test on the density function, which showed a better RPM correlation with the input for #203-. The visual check reflected the superior RPM density curve, and #203- was chosen.

Figure 1

L.A. Gas Non-Freeway
203887989

Key: — Cycle
----- Input

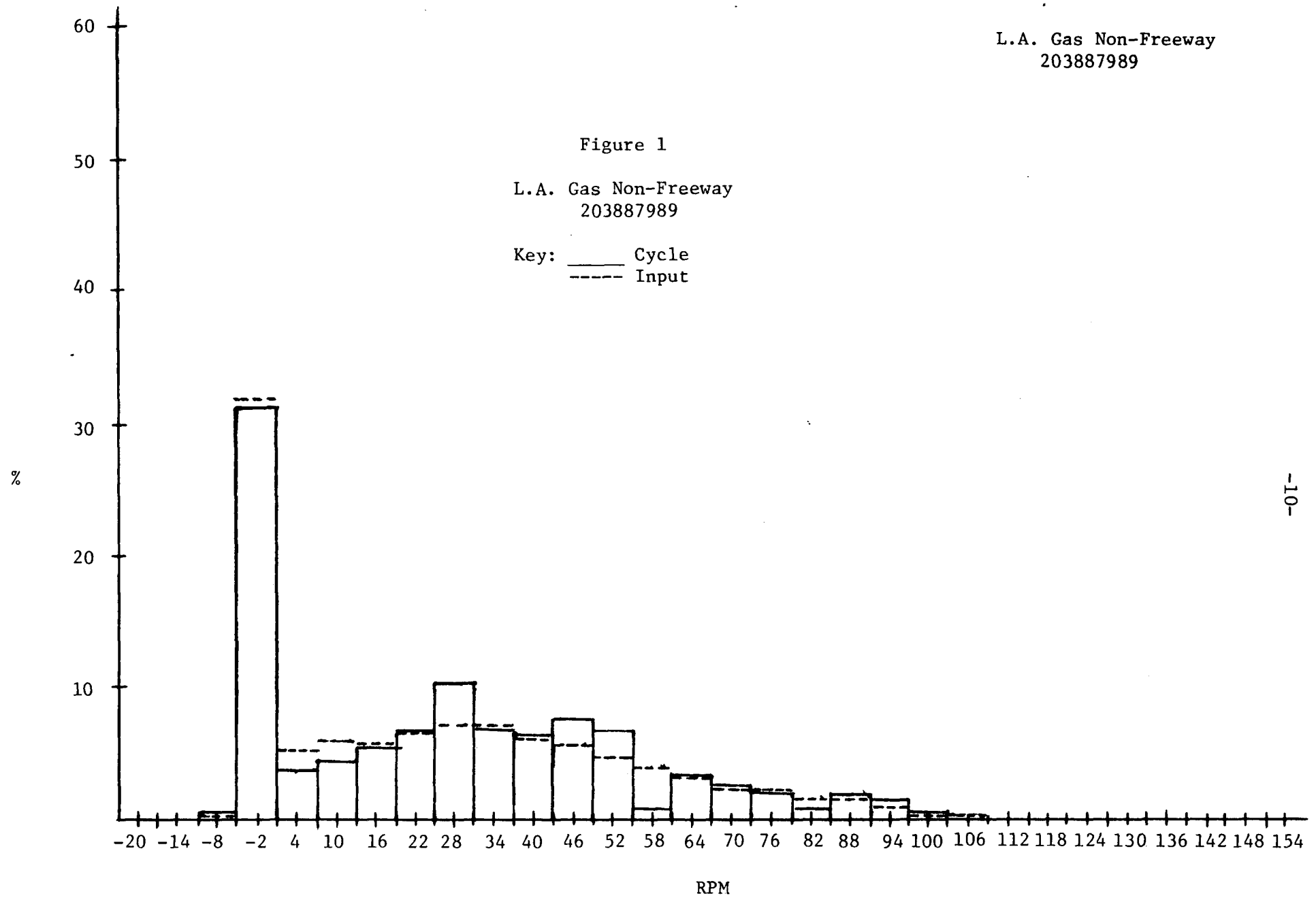


Figure 2

L.A. Gas Freeway
296644805

Key: _____ Cycle
 ----- Input

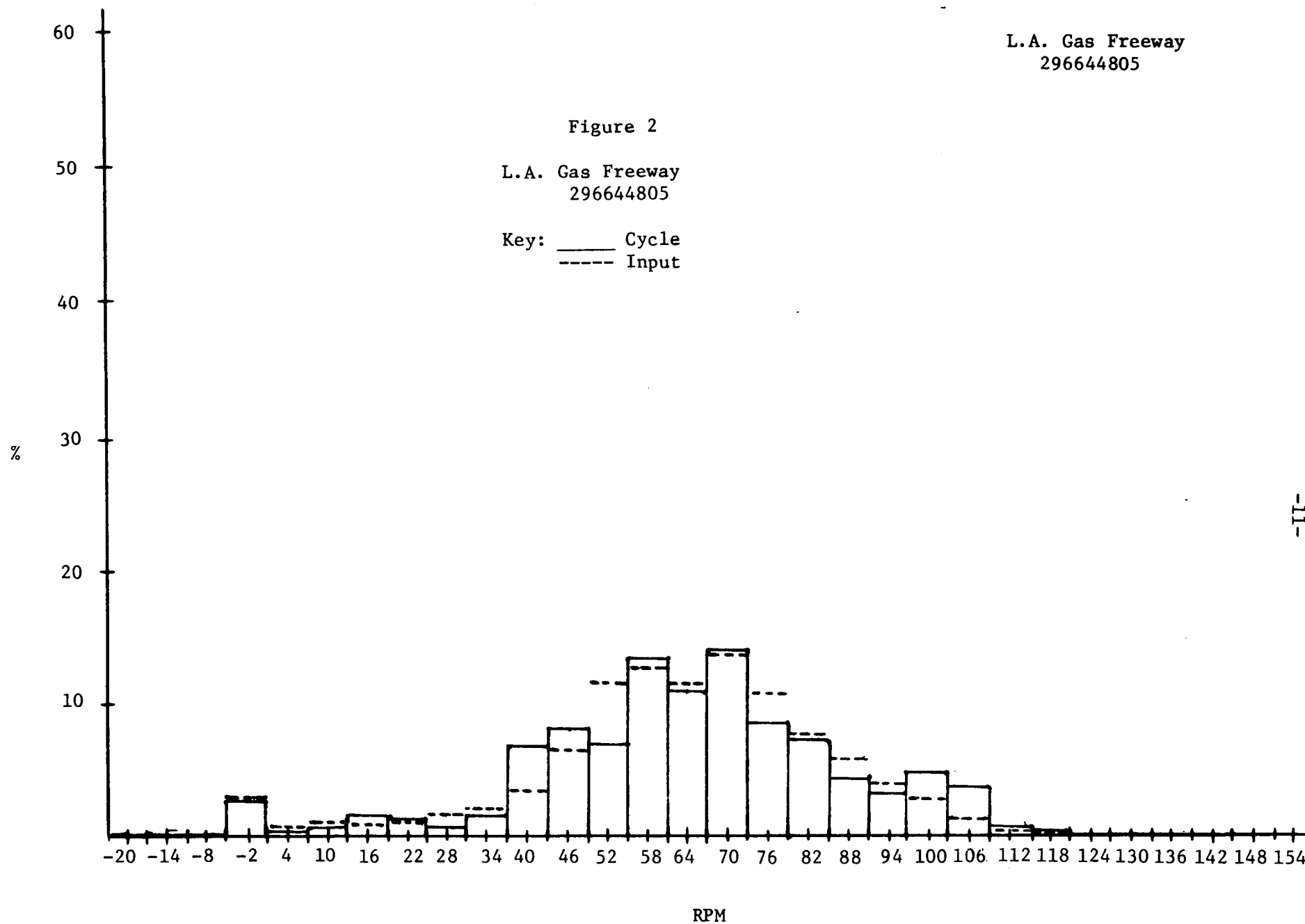
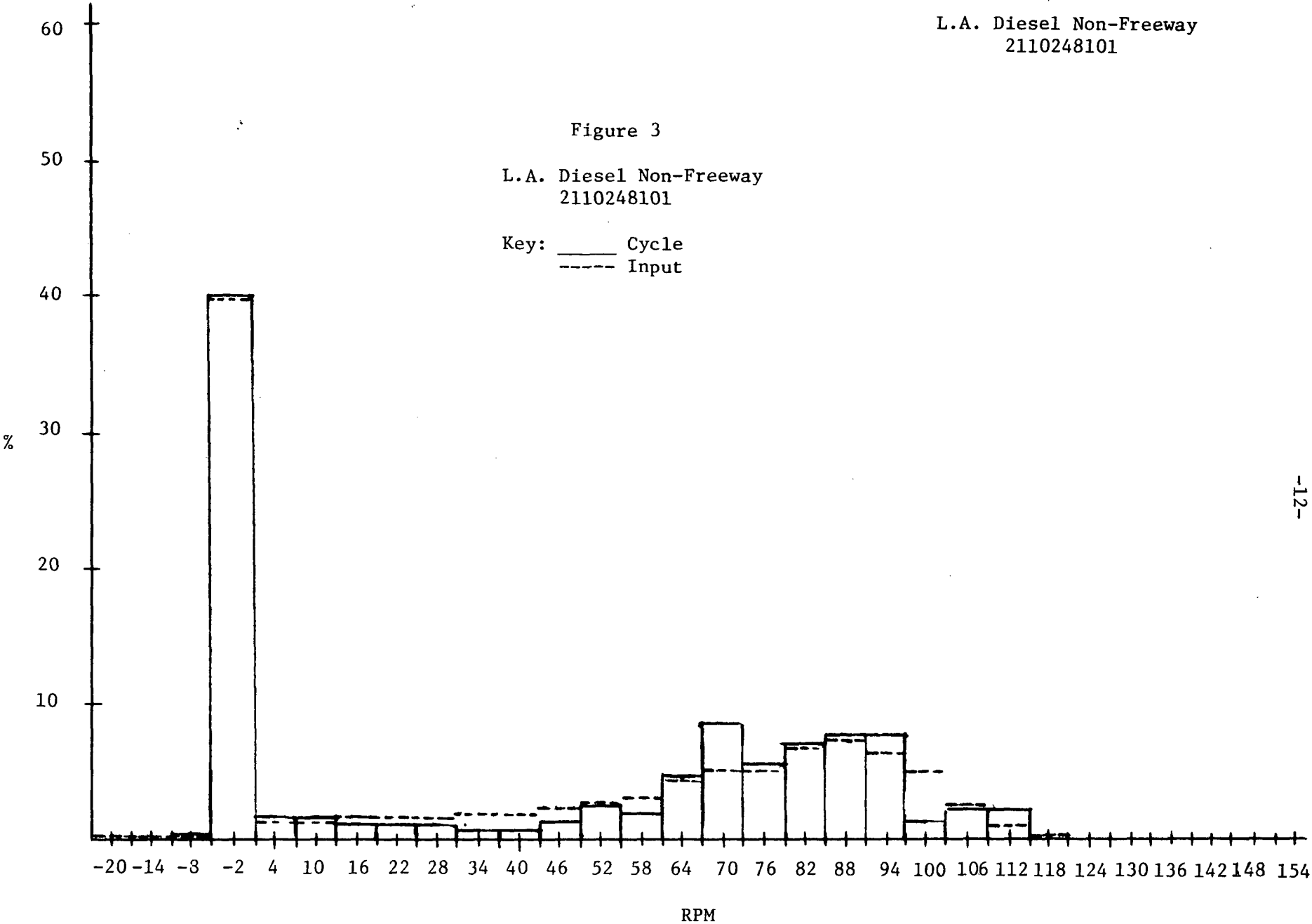


Figure 3

L.A. Diesel Non-Freeway
2110248101

Key: — Cycle
----- Input

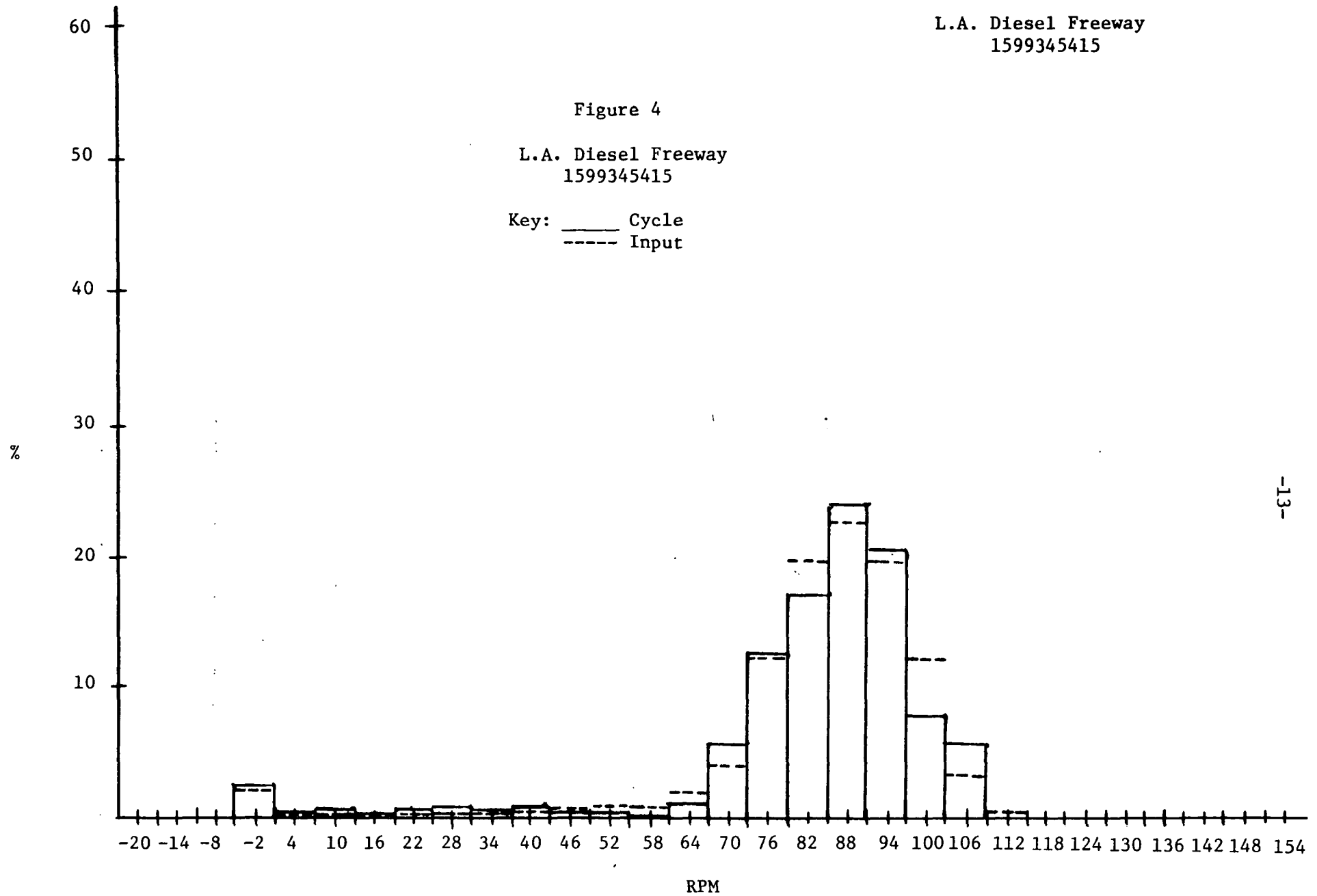


L.A. Diesel Freeway
1599345415

Figure 4

L.A. Diesel Freeway
1599345415

Key: — Cycle
----- Input

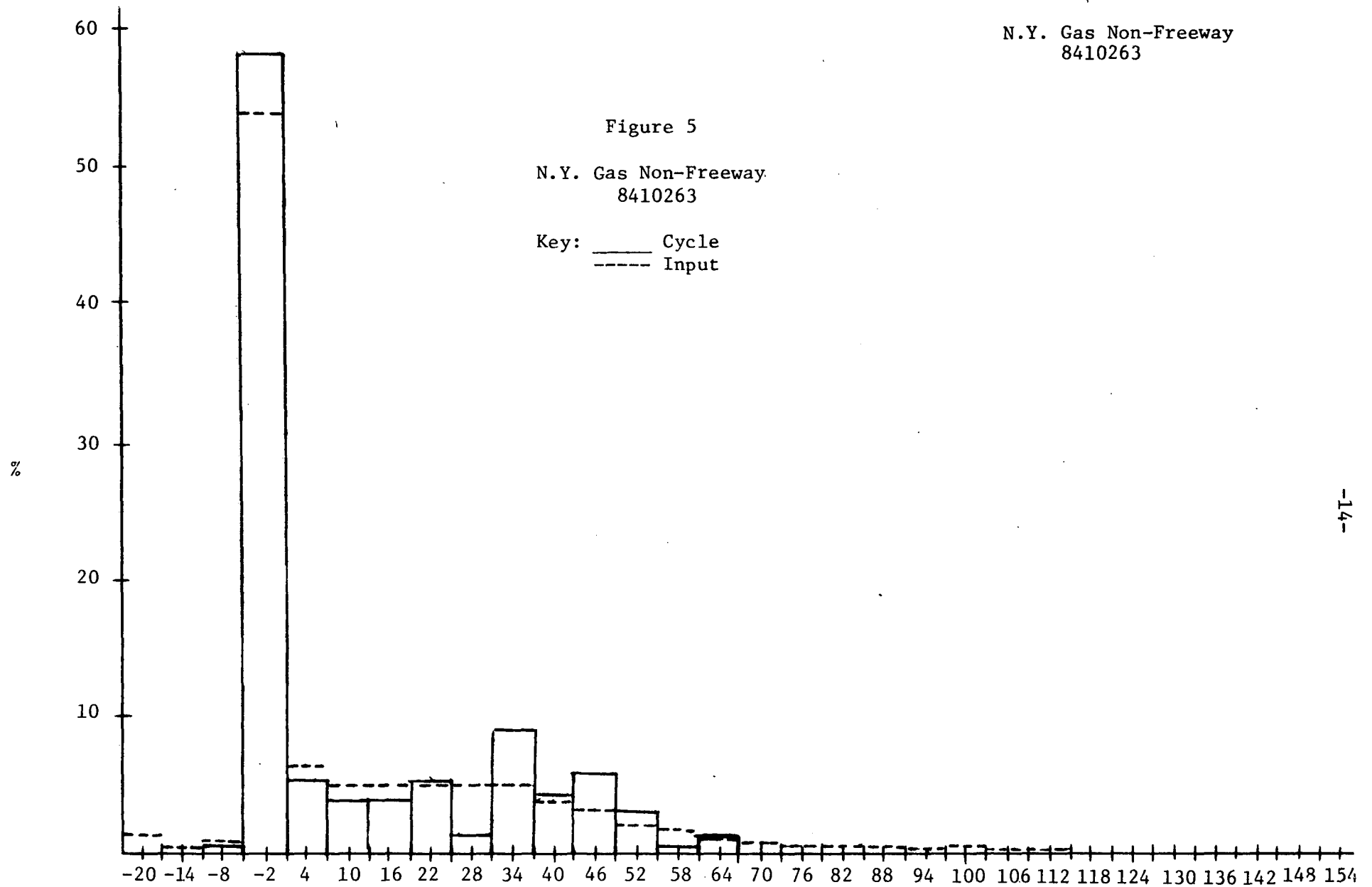


N.Y. Gas Non-Freeway
8410263

Figure 5

N.Y. Gas Non-Freeway
8410263

Key: — Cycle
----- Input

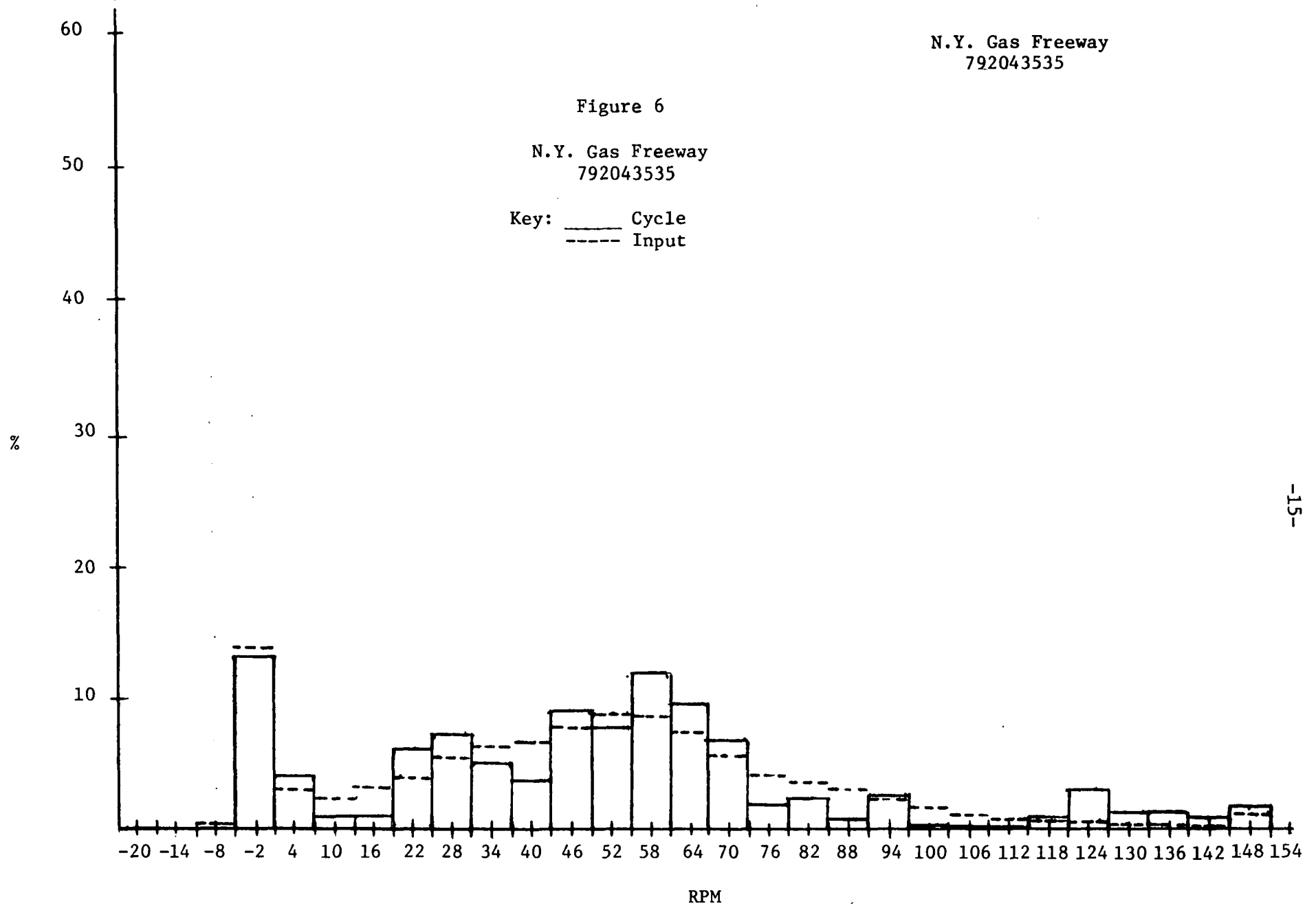


N.Y. Gas Freeway
792043535

Figure 6

N.Y. Gas Freeway
792043535

Key: — Cycle
----- Input

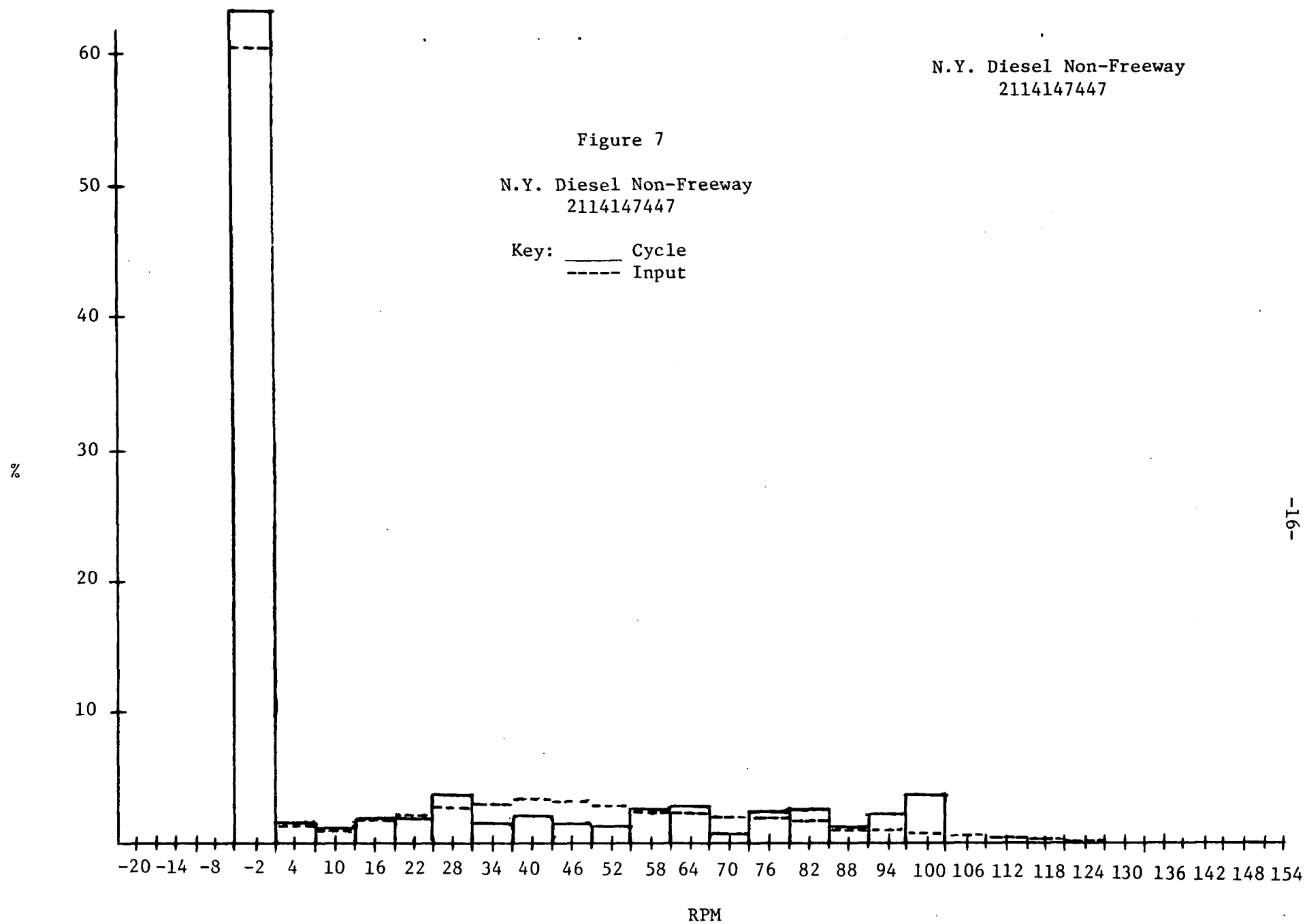


N.Y. Diesel Non-Freeway
2114147447

Figure 7

N.Y. Diesel Non-Freeway
2114147447

Key: — Cycle
----- Input



N.Y. Diesel Freeway
104099549

Figure 8

N.Y. Diesel Freeway
104099549

Key: — Cycle
----- Input

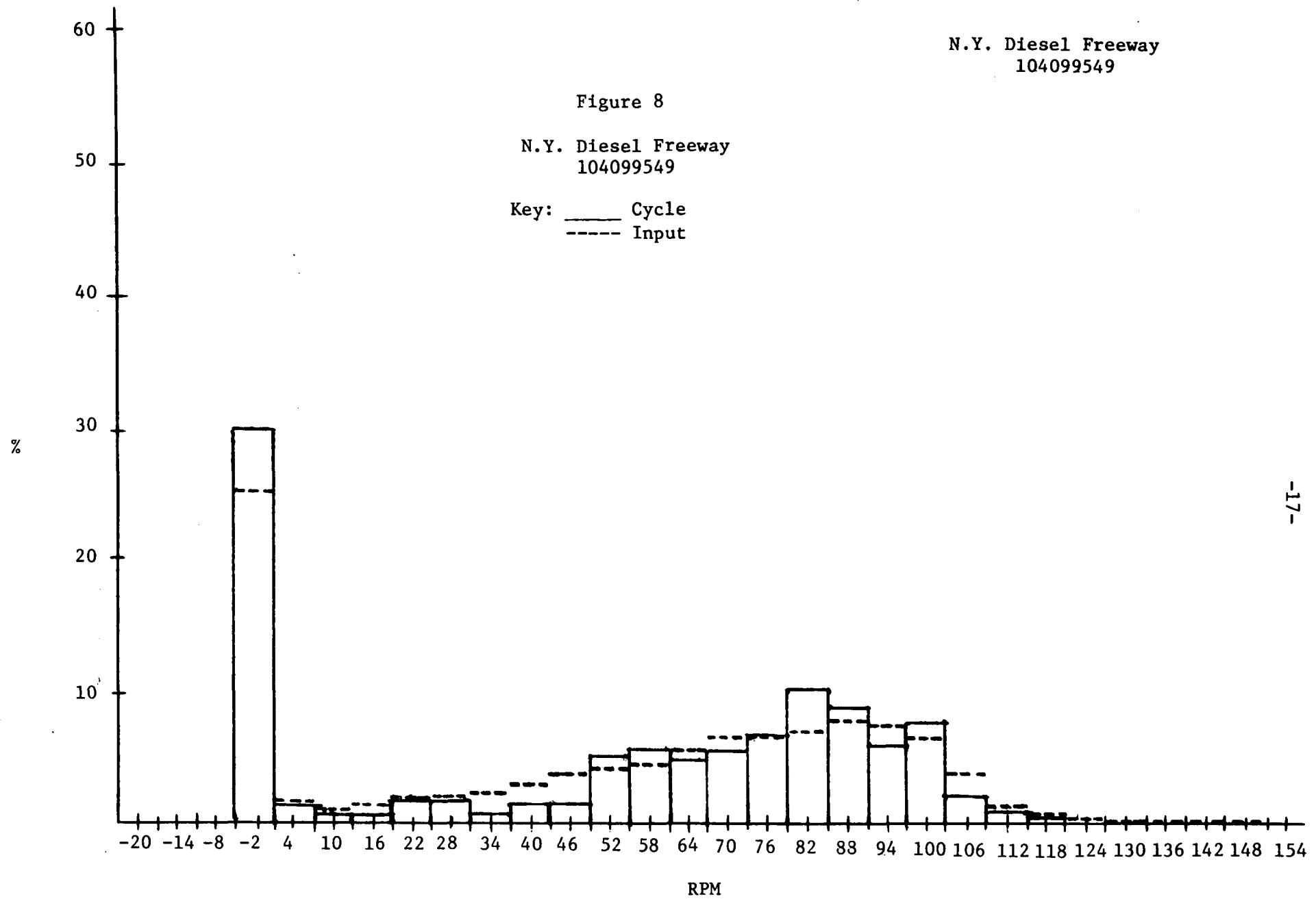
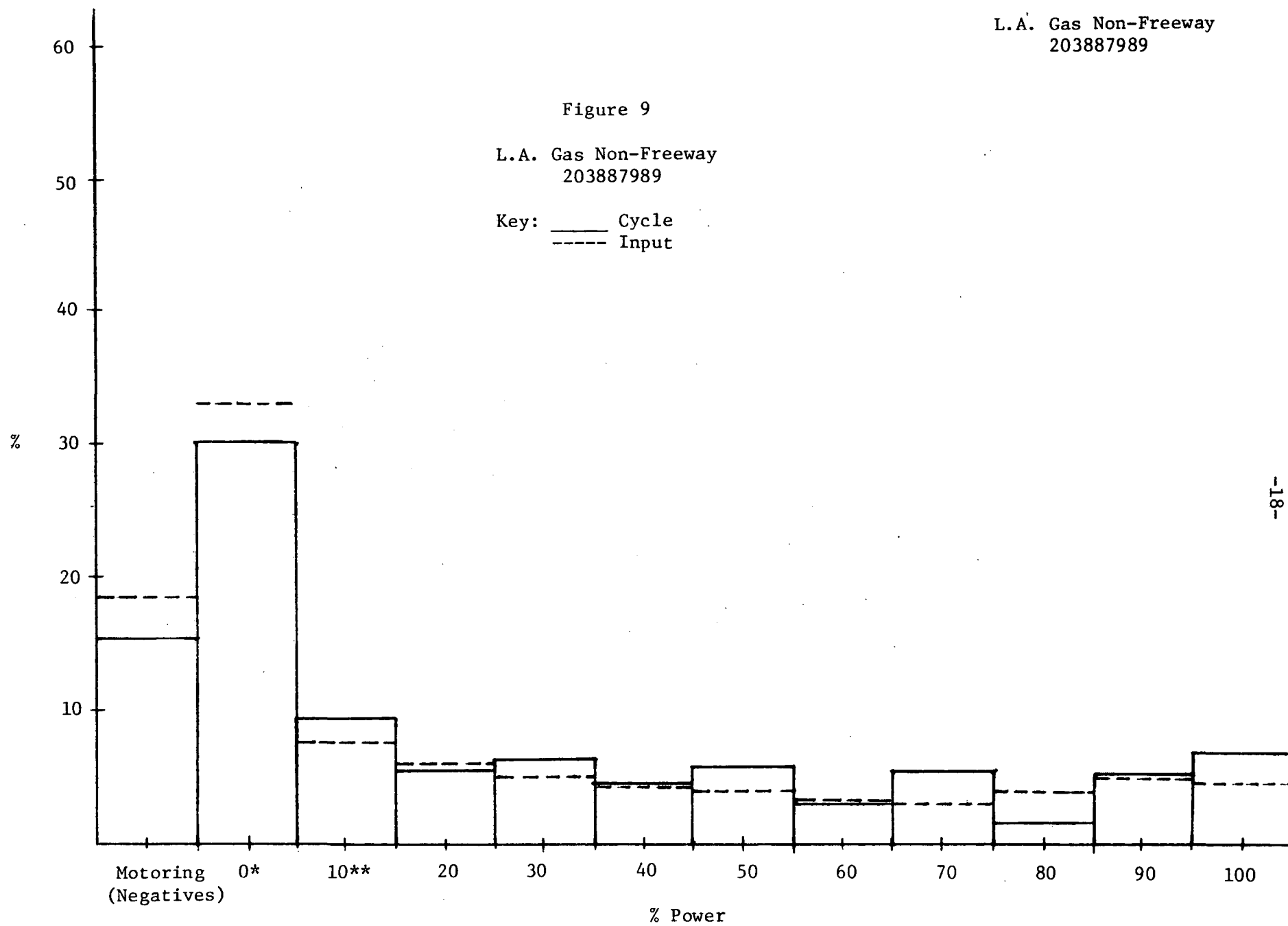


Figure 9

L.A. Gas Non-Freeway
203887989

Key: — Cycle
----- Input



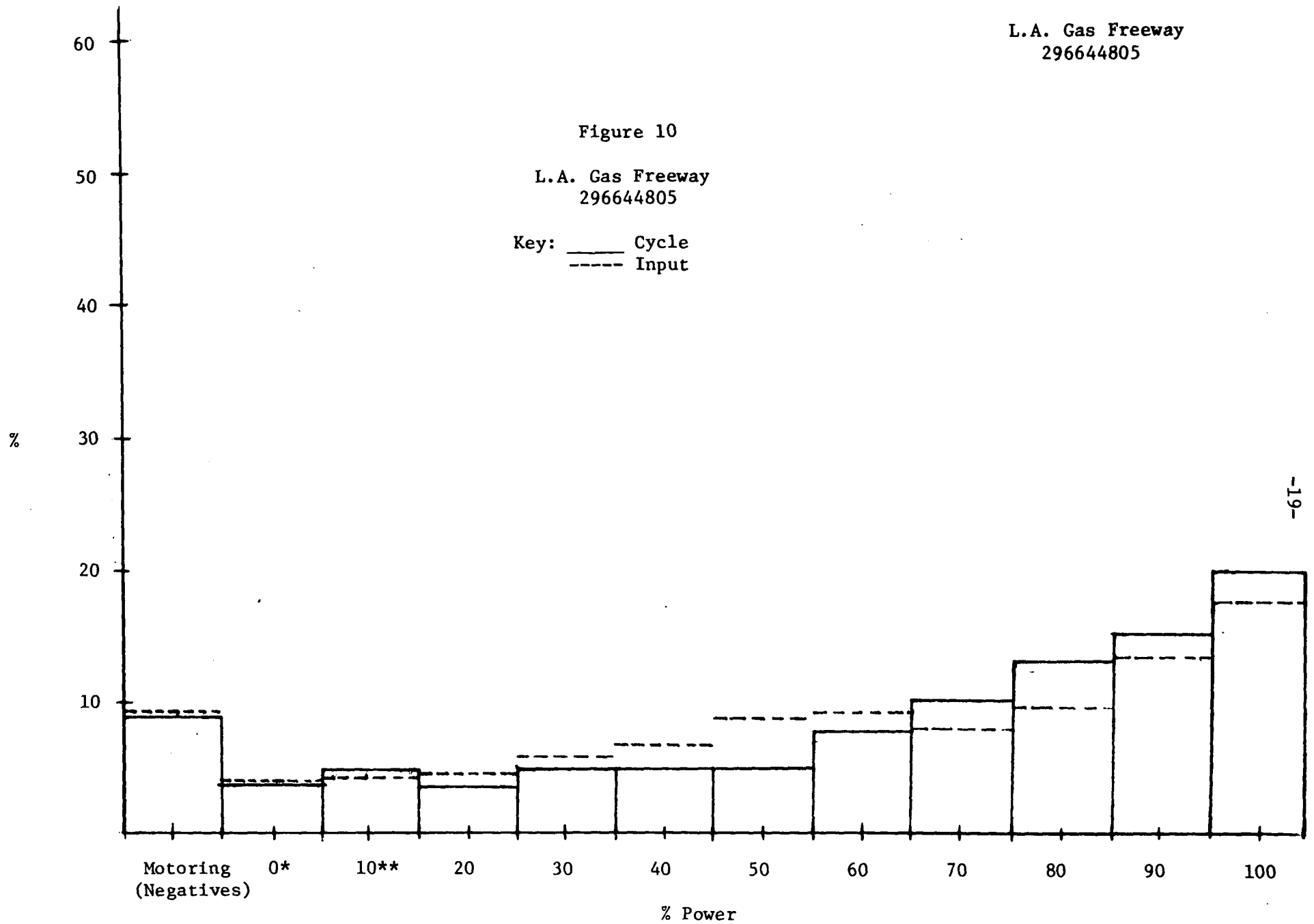
* $0 \leq \% < 5$

** $5 \leq \% < 15$

Figure 10

L.A. Gas Freeway
296644805

Key: — Cycle
----- Input



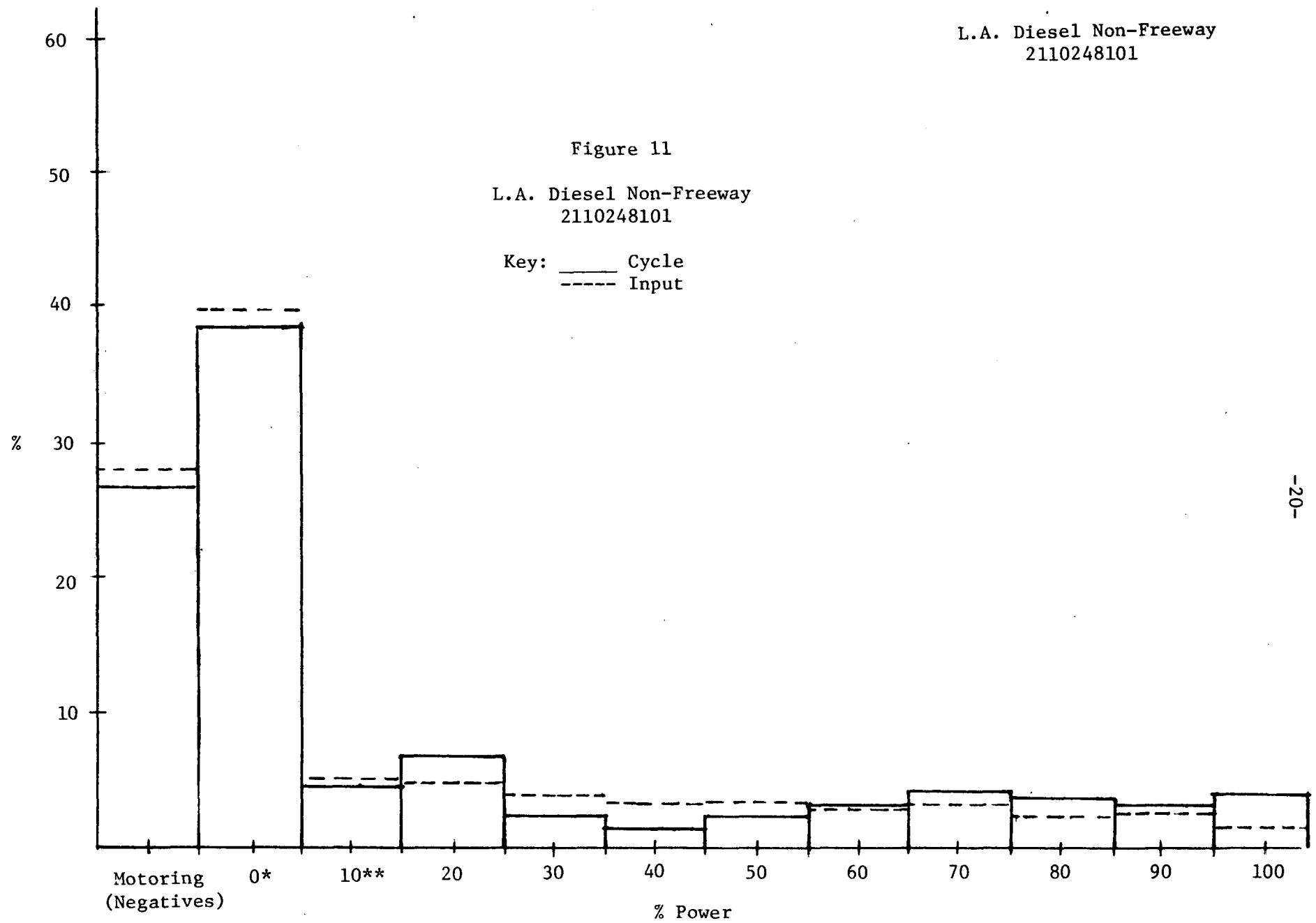
* $0 \leq \% < 5$

** $5 \leq \% < 15$

Figure 11

L.A. Diesel Non-Freeway
2110248101

Key: — Cycle
----- Input



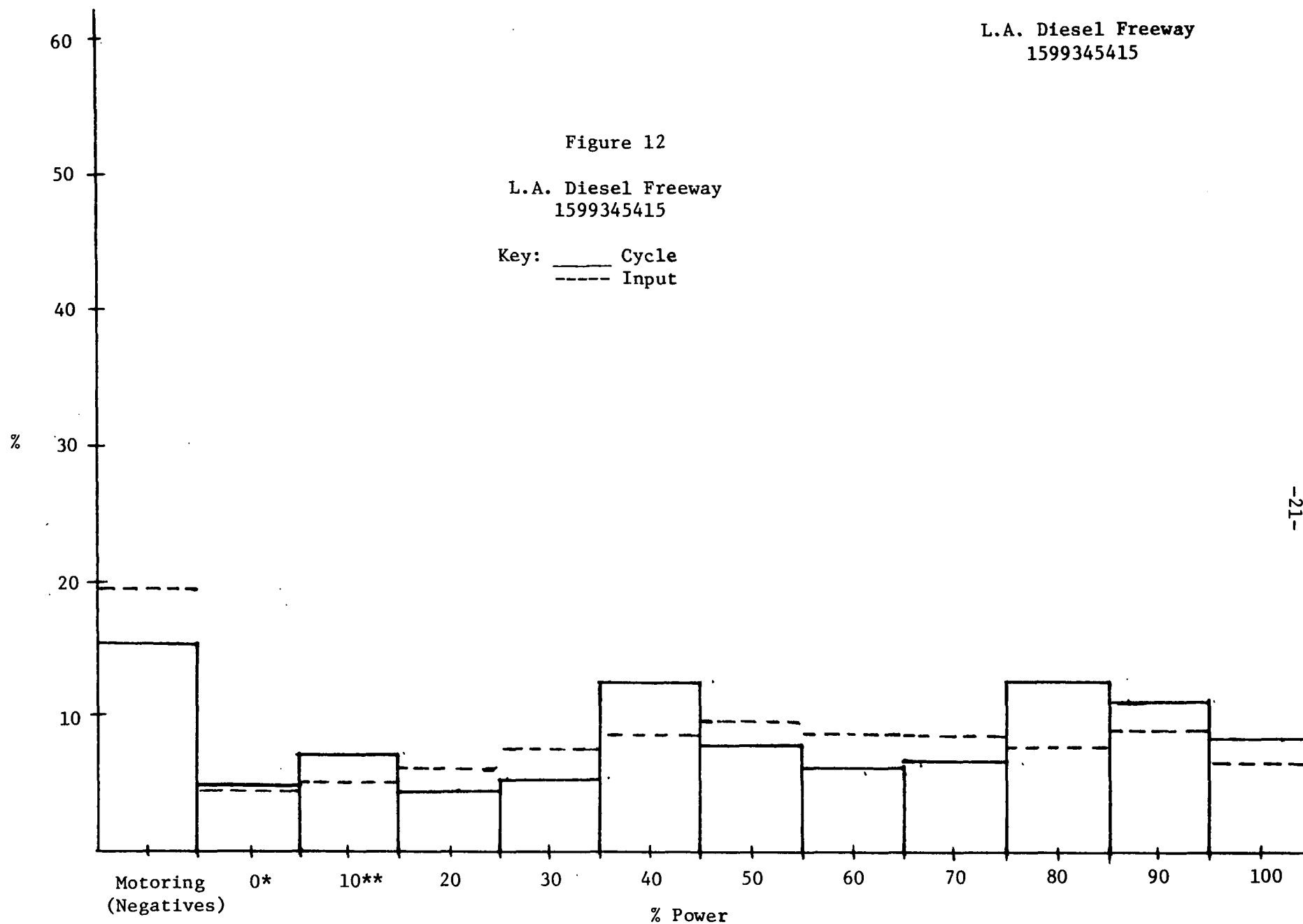
* $0 \leq \% < 5$

** $5 \leq \% < 15$

Figure 12

L.A. Diesel Freeway
1599345415

Key: _____ Cycle
----- Input

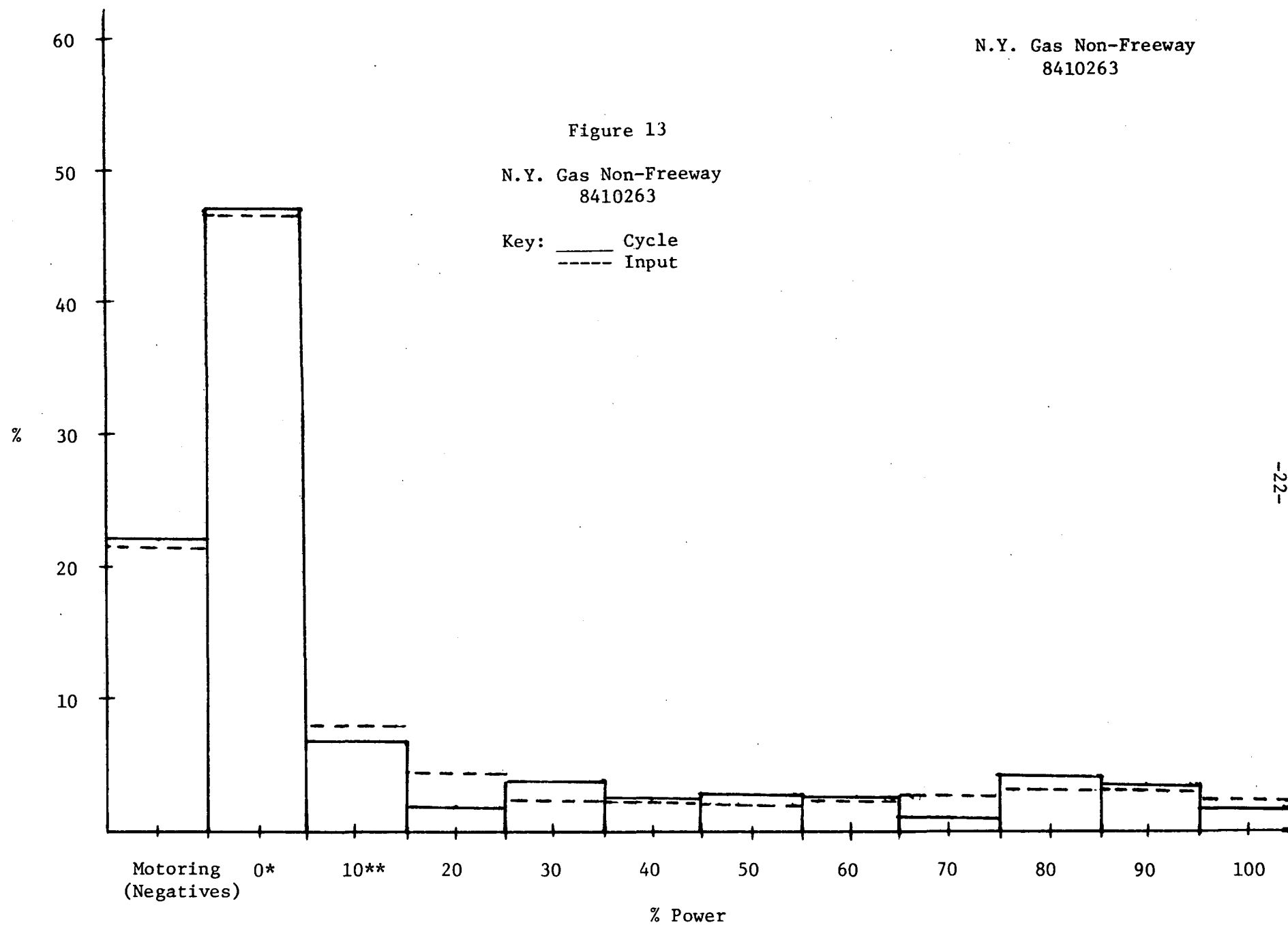


* $0 \leq \% < 5$
** $5 \leq \% < 15$

Figure 13

N.Y. Gas Non-Freeway
8410263

Key: _____ Cycle
 ----- Input



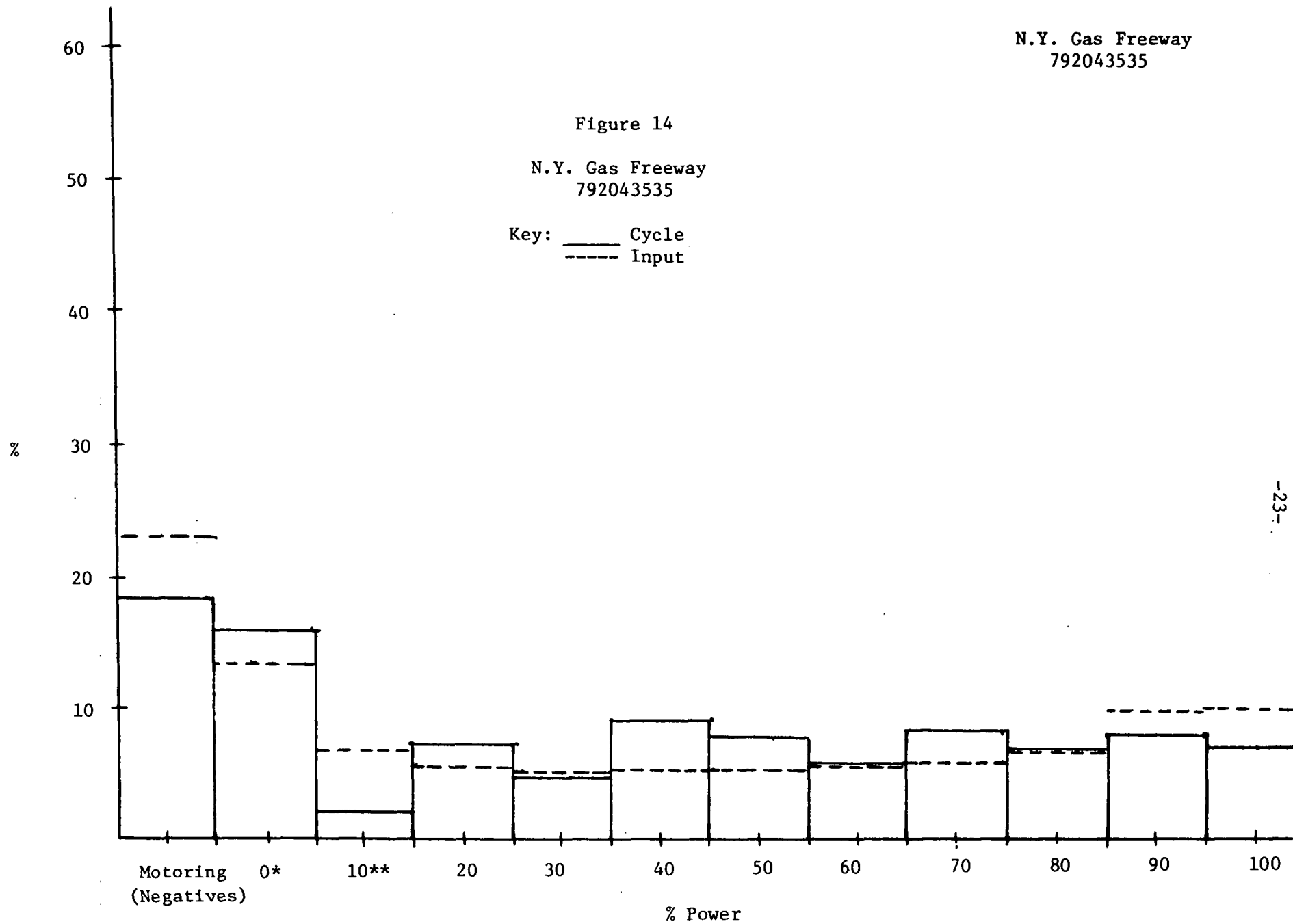
* $0 \leq \% < 5$

** $5 \leq \% < 15$

Figure 14

N.Y. Gas Freeway
792043535

Key: — Cycle
----- Input

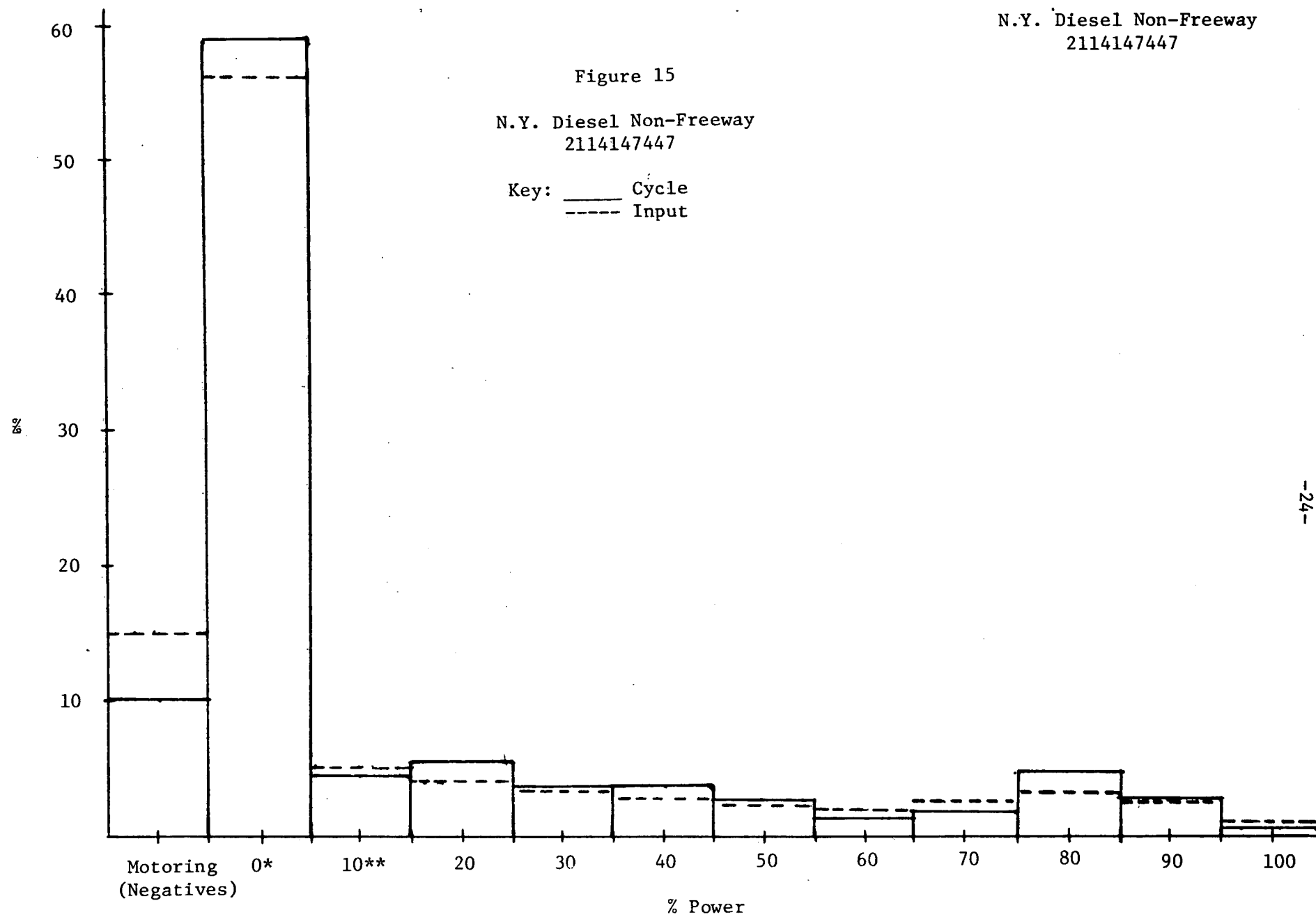


* $0 \leq \% < 5$
** $5 \leq \% < 15$

Figure 15

N.Y. Diesel Non-Freeway
2114147447

Key: _____ Cycle
 ----- Input

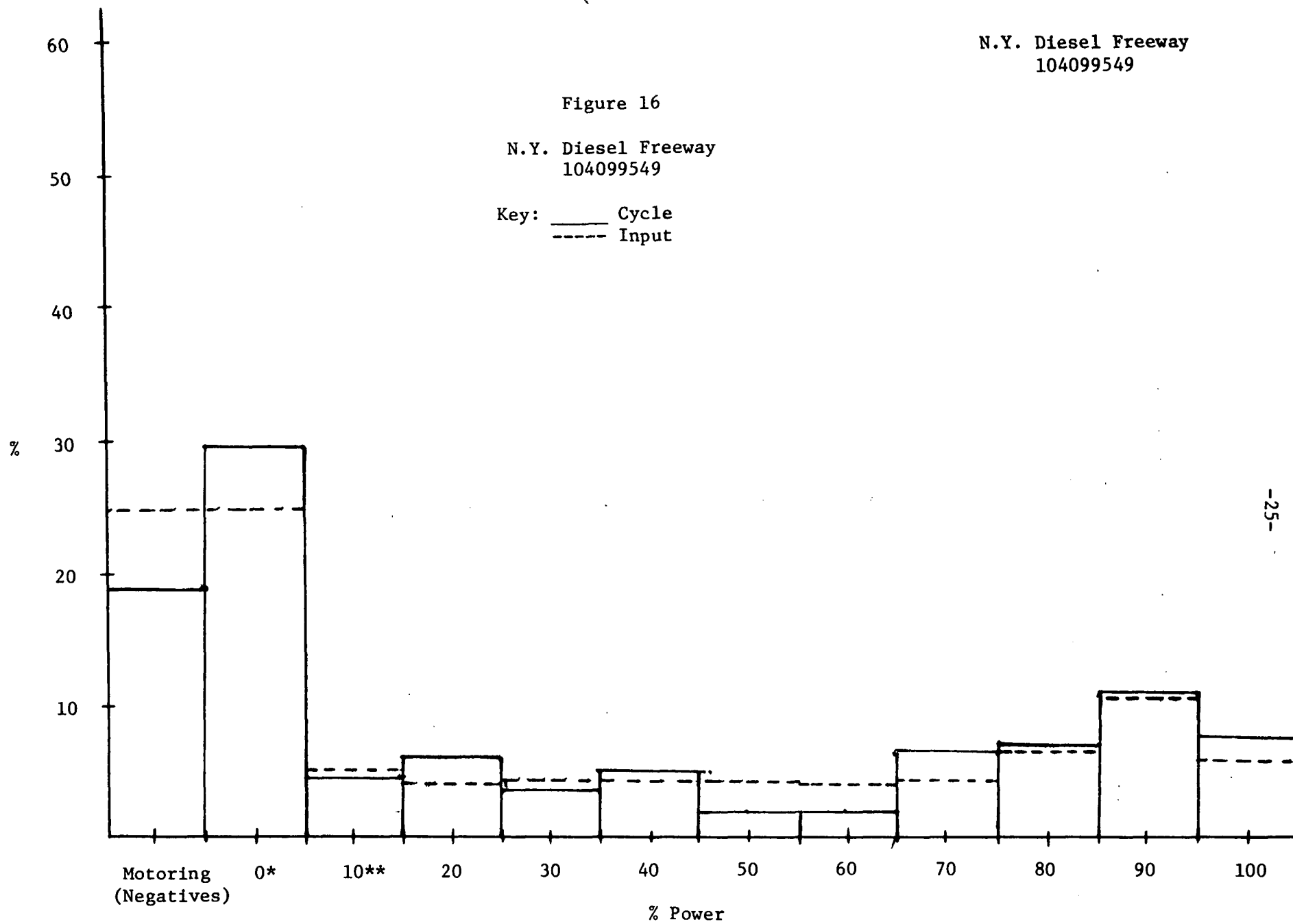


* $0 \leq \% < 5$
5 $\leq \% < 15$

Figure 16

N.Y. Diesel Freeway
104099549

Key: — Cycle
----- Input



* $0 \leq \% < 5$
** $5 \leq \% < 15$

Table 6

Qualitative Ranking Based on Visual Inspection of Plots

<u>Category</u>			<u>Cycle</u>	<u>Ranking</u>
LA	Gas	Non-Freeway	850-	2
			203-	1
			2113-	2
		Freeway	296-	1
			125-	2
			122-	2
	Diesel	Non-Freeway	2110-	1
			212-	3
			279-	2
		Freeway	159-	1
			109-	1
			110-	1
NY	Gas	Non-Freeway	841-	1
			210-	1
			214-	2
		Freeway	792-	1
			229-	3
			202-	2
	Diesel	Non-Freeway	2114-	1
			2145-	1
			561-	2
		Freeway	812-	2
			769-	3
			104-	1

Table 7

Ranking Summary and Final Rankings

			Summary	Distribution	Visual			
			Statistics	K-S Test	Ranking			
			(Table 4)	(Table 5)	of Plots		Final	
<u>Category</u>			<u>Cycle</u>		(Table 6)	<u>Scores</u>	<u>Ranking</u>	
LA	Gas	Non-Freeway	850-	3	3	2	8	3
			203-	1	1	1	3	1*
			2113-	2	2	2	6	2
		Freeway	296-	1	2	1	4	1*
			125-	3	3	2	8	3
			122-	2	1	2	5	2
	Diesel	Non-Freeway	2110-	1	1	1	3	1*
			212-	3	3	3	9	3
			279-	2	2	2	6	2
		Freeway	159-	1	2	1	4	1*
			109-	2	1	1	4	1
			110-	2	3	1	6	2
NY	Gas	Non-Freeway	841-	1	1	1	3	1*
			210-	3	2	1	6	2
			214-	2	3	2	7	3
		Freeway	792-	1	1	1	3	1*
			229-	3	2	3	8	3
			202-	2	2	2	6	2
	Diesel	Non-Freeway	2114-	2	1	1	4	1*
			2145-	3	1	1	5	2
			561-	1	2	2	5	2
		Freeway	812-	3	2	2	7	3
			769-	1	2	3	6	2
			104-	2	1	1	4	1*

* Indicates the chosen cycle in each category.

LA Gas Freeway: The summary statistics heavily favor cycle 296-, but this cycle fails the density K-S test for power. However, the other candidates also did poorly; and since the K-S difference which failed the power density function is relatively low for #296- * and the RPM test was passed easily, it seemed to be the best choice. Further, comparison of the input and cycle density plots for #296- shows no massive divergence, although there is slightly more operation in the higher power range than might be desirable.

LA Diesel Non-Freeway: Of the three candidates, cycles 211- and 279- are in contention as regards the statistics, with #211- favored on the basis of its high score in the overall matrix K-S significance level (.80). As far as the density K-S correlations are concerned, the chosen cycle 211- is better, as borne out by the density plots themselves (211- shows smoother functions).

LA Diesel Freeway: The statistics clearly favor cycle 159-, especially with the high overall matrix significance level. Cycle 109-, however, scored better on the density K-S test, and visual comparison also showed that both cycles were in contention with respect to density. The final choice of 159- reflects the greater weight given to the summary statistics, although cycle 109- would not have been an unreasonable choice.

NY Gas Non-Freeway: There can be little doubt that cycle 841- is the best choice for this category; both the summary statistics and the density K-S test strongly favor this cycle. The visual check supports the choice as well.

NY Gas Freeway: Again, this choice was not difficult. The best statistics are found for cycle 792-, and it is the only cycle to pass the power density K-S test. The density plots -- especially those depicting RPM-- further bear out this selection.

NY Diesel Non-Freeway: The scoring of the summary statistics showed cycles 211- and 561- to be very close contenders, with #214- a close third. Since all three passed the density K-S test rather nicely, the decision was not clear-cut. Cycle 561- is not as good as the others according to the power K-S test, and #214- is lacking in summary statistics; hence the choice was #211-. The density plots were so similar that the visual test was of little help.

NY Diesel Freeway: In contention here, by the statistics, are cycles 769- and 104-, perhaps with a slight advantage toward the former. However, only #104- passed both the power and RPM K-S tests. Since the density plots for #769 show an excessive amount of operation in the higher power ranges, cycle 104- becomes the reasonable choice.

* Critical difference was .085 at $\alpha = .01$, maximum difference for cycle was .105.

Conclusions

The table below shows the selected cycle for each category; the cycles are denoted by their random number designations.

	<u>Category</u>		<u>Cycle</u>
LA	Gas	Non-Freeway	203887989
	Gas	Freeway	296644805
	Diesel	Non-Freeway	2110248101
	Diesel	Freeway	1599345415
NY	Gas	Non-Freeway	8410263
	Gas	Freeway	792043535
	Diesel	Non-Freeway	2114147447
	Diesel	Freeway	104099549

Second-by-second listings for these cycles may be found in the Appendix.

These cycles are judged to be the most representative of the CAPE-21 data base. The selections are made based upon statistical considerations only. Further evaluation of the candidate cycles must still be made in terms of the practical aspects of running the cycles on the dynamometer.

APPENDIX A

Sample K-S test on density function

LA Gas Non-Freeway - Cycle 2038877989

	<u>RPM</u>		
	% RPM		
Increment of % RPM	Cumulative Distr. Function (Input)	Cumulative Distr. Function (Cycle)	K-S Difference
-20	0	0	0
-14	.001	0	0
- 8	.003	.003	0
- 2	.317	.309	.008
4	.368	.346	.022
10	.424	.388	.036
16	.478	.439	.039*
22	.540	.504	.036
28	.606	.605	.001
34	.672	.667	.005
40	.733	.729	.004
46	.788	.802	-.014
52	.834	.867	-.033
58	.872	.875	-.003
64	.903	.906	-.003
70	.930	.931	-.001
76	.951	.948	-.003
82	.968	.954	.014
88	.982	.971	.011
94	.990	.985	.005
100	.944	.988	.006
106	.995	.988	.007
112	.996	.988	.008
118	.996	.988	.008
124	.996	.988	.008

The * indicates the maximum difference incurred in the test -- .039.
The sample size (number of records) for this cycle is 356; so, by Table 2, the critical difference for a significance level of .20 is .057.
Thus the cycle passes this RPM test at the high .20 level.

APPENDIX B

Second-by-Second Listings
of Selected Cycles

CYCLE #203 887 798 9
LOS ANGELES - All Gasoline
NON-FREEWAY

SECONDS	% RPM	% POWER	SECOND	% RPM	% POWER	SECOND	% RPM	% POWER	SECOND	% RPM	% POWER
0.	0.0	0.0	50.	0.0	0.0	100.	13.04	MOTORING	150.	0.0	0.0
1.	0.0	0.0	51.	0.0	0.02	101.	0.41	79.70	151.	0.0	0.0
2.	0.0	0.0	52.	0.37	41.08	102.	10.33	100.00	152.	0.0	0.0
3.	0.0	0.0	53.	2.68	90.00	103.	17.27	100.00	153.	0.0	0.0
4.	0.0	0.0	54.	6.00	94.99	104.	22.00	100.00	154.	0.0	0.0
5.	0.0	0.0	55.	11.94	100.00	105.	25.16	100.00	155.	0.0	0.0
6.	0.0	0.0	56.	15.63	100.00	106.	29.37	100.00	156.	0.0	0.0
7.	0.0	0.0	57.	41.26	90.28	107.	36.73	66.35	157.	0.0	0.0
8.	0.0	0.0	58.	46.26	90.00	108.	40.00	MOTORING	158.	0.0	0.0
9.	0.0	4.17	59.	44.56	67.08	109.	23.50	MOTORING	159.	0.26	0.70
10.	1.15	10.00	60.	36.00	1.12	110.	9.37	MOTORING	160.	16.60	31.83
11.	2.00	10.00	61.	27.58	50.12	111.	8.00	MOTORING	161.	45.32	29.78
12.	9.22	10.00	62.	23.52	90.00	112.	6.74	MOTORING	162.	43.00	10.00
13.	0.0	0.0	63.	24.00	90.00	113.	2.86	MOTORING	163.	40.69	10.00
14.	0.0	0.0	64.	26.29	70.00	114.	0.11	MOTORING	164.	35.12	10.00
15.	0.0	0.0	65.	30.00	65.38	115.	0.0	MOTORING	165.	28.18	19.70
16.	0.0	0.0	66.	30.00	34.47	116.	0.0	0.0	166.	28.26	47.45
17.	0.0	0.0	67.	30.00	10.00	117.	0.0	0.0	167.	30.00	30.00
18.	0.0	0.0	68.	30.00	10.00	118.	0.0	0.0	168.	30.00	30.00
19.	0.0	0.0	69.	30.00	10.00	119.	0.0	0.0	169.	30.00	30.00
20.	0.0	0.0	70.	30.18	60.00	120.	0.0	0.0	170.	34.54	30.00
21.	0.0	0.0	71.	40.00	58.25	121.	0.0	0.0	171.	36.00	30.00
22.	0.0	0.0	72.	40.67	50.00	122.	0.0	0.0	172.	36.43	30.00
23.	0.0	0.0	73.	41.02	50.00	123.	0.0	0.0	173.	43.84	30.00
24.	0.0	0.0	74.	40.00	50.00	124.	0.0	0.0	174.	50.00	30.00
25.	0.0	0.0	75.	41.61	50.00	125.	0.0	0.0	175.	50.00	24.56
26.	0.0	0.0	76.	42.00	50.00	126.	0.0	0.0	176.	50.00	20.00
27.	0.0	0.0	77.	46.00	50.00	127.	0.0	0.0	177.	50.00	-999.99
28.	0.0	0.07	78.	48.22	50.00	128.	0.0	0.0	178.	37.97	-999.99
29.	0.0	10.00	79.	59.21	50.69	129.	0.0	0.0	179.	35.30	-999.99
30.	0.0	17.22	80.	67.18	70.00	130.	0.0	0.0	180.	30.68	-999.99
31.	0.0	20.00	81.	71.00	70.00	131.	0.0	0.0	181.	27.02	-999.99
32.	0.0	20.37	82.	72.00	70.00	132.	0.0	0.0	182.	26.00	-999.99
33.	2.33	31.94	83.	72.13	69.08	133.	0.0	0.0	183.	26.00	-999.99
34.	16.22	36.48	84.	74.89	29.94	134.	0.0	0.0	184.	20.24	-999.99
35.	24.00	24.91	85.	68.91	MOTORING	135.	0.0	0.0	185.	14.00	-999.99
36.	24.00	13.34	86.	49.71	MOTORING	136.	0.0	0.0	186.	13.45	18.27
37.	19.06	10.00	87.	41.84	MOTORING	137.	0.0	0.0	187.	9.40	52.99
38.	19.00	MOTORING	88.	38.30	MOTORING	138.	0.0	0.0	188.	10.72	81.81
39.	17.17	MOTORING	89.	35.93	MOTORING	139.	0.0	0.0	189.	15.50	97.48
40.	9.04	MOTORING	90.	20.00	MOTORING	140.	0.0	0.0	190.	19.62	100.00
41.	1.09	MOTORING	91.	23.48	MOTORING	141.	0.0	0.0	191.	20.25	100.00
42.	0.0	0.0	92.	10.16	MOTORING	142.	0.0	0.0	192.	25.76	100.00
43.	0.0	0.0	93.	4.72	MOTORING	143.	0.0	0.0	193.	35.02	100.00
44.	0.0	0.0	94.	0.82	5.90	144.	0.0	0.0	194.	42.14	94.65
45.	0.0	0.0	95.	-9.53	19.53	145.	0.0	0.0	195.	44.00	90.00
46.	0.0	0.0	96.	2.20	45.60	146.	0.0	0.0	196.	45.70	90.00
47.	0.0	0.0	97.	20.53	7.33	147.	2.27	20.00	197.	51.99	60.00
48.	0.0	0.0	98.	21.15	0.0	148.	2.82	14.11	198.	50.00	60.00
49.	0.0	0.0	99.	17.67	MOTORING	149.	0.0	0.0	199.	51.29	63.22

CYCLE #203 887 7989

(Page 2)

SECONDS	% RPM	% POWER	SECONDS	% RPM	% POWER	SECONDS	% RPM	% POWER			
200.	54.96	70.00	250.	67.38	56.88	300.	17.59	MOTRING	-0.	-0.00	-0.00
201.	56.00	70.00	251.	80.02	54.96	301.	11.65	MOTRING	-0.	-0.00	-0.00
202.	62.35	38.25	252.	93.95	66.34	302.	1.92	MOTRING	-0.	-0.00	-0.00
203.	71.61	30.00	253.	97.63	63.69	303.	0.0	0.0	-0.	-0.00	-0.00
204.	76.22	50.00	254.	94.11	60.00	304.	0.0	0.0	-0.	-0.00	-0.00
205.	78.00	50.00	255.	85.66	MOTRING	305.	0.0	0.0	-0.	-0.00	-0.00
206.	78.00	41.53	256.	70.00	MOTRING	306.	0.0	0.0	-0.	-0.00	-0.00
207.	55.93	12.58	257.	69.11	MOTRING	307.	0.0	0.0	-0.	-0.00	-0.00
208.	39.52	0.0	258.	66.80	MOTRING	0.	-0.00	-0.00	-0.	-0.00	-0.00
209.	34.42	71.65	259.	64.48	MOTRING	0.	-0.00	-0.00	-0.	-0.00	-0.00
210.	36.11	79.47	260.	53.00	44.98	0.	-0.00	-0.00	-0.	-0.00	-0.00
211.	38.84	67.90	261.	52.73	49.27	0.	-0.00	-0.00	-0.	-0.00	-0.00
212.	42.74	60.00	262.	62.00	40.00	0.	-0.00	-0.00	-0.	-0.00	-0.00
213.	44.00	54.75	263.	62.00	43.88	0.	-0.00	-0.00	-0.	-0.00	-0.00
214.	49.46	36.35	264.	64.18	44.55	0.	-0.00	-0.00	-0.	-0.00	-0.00
215.	52.00	30.00	265.	53.36	4.88	0.	-0.00	-0.00	-0.	-0.00	-0.00
216.	32.05	MOTRING	266.	46.28	15.79	0.	-0.00	-0.00	-0.	-0.00	-0.00
217.	25.69	0.0	267.	46.00	19.83	0.	-0.00	-0.00	-0.	-0.00	-0.00
218.	24.00	0.0	268.	45.65	10.00	0.	-0.00	-0.00	-0.	-0.00	-0.00
219.	24.00	MOTRING	269.	45.99	10.00	0.	-0.00	-0.00	-0.	-0.00	-0.00
220.	20.24	MOTRING	270.	48.05	10.00	0.	-0.00	-0.00	-0.	-0.00	-0.00
221.	19.16	68.43	271.	44.71	3.54	0.	-0.00	-0.00	-0.	-0.00	-0.00
222.	9.00	80.58	272.	48.82	MOTRING	0.	-0.00	-0.00	-0.	-0.00	-0.00
223.	10.20	80.99	273.	51.92	66.82	0.	-0.00	-0.00	-0.	-0.00	-0.00
224.	13.54	90.00	274.	47.53	MOTRING	0.	-0.00	-0.00	-0.	-0.00	-0.00
225.	19.00	94.13	275.	36.31	9.23	0.	-0.00	-0.00	-0.	-0.00	-0.00
226.	20.28	100.00	276.	17.73	55.68	0.	-0.00	-0.00	-0.	-0.00	-0.00
227.	22.00	100.00	277.	29.43	38.22	0.	-0.00	-0.00	-0.	-0.00	-0.00
228.	23.77	91.15	278.	36.00	37.46	0.	-0.00	-0.00	-0.	-0.00	-0.00
229.	28.08	90.00	279.	36.00	40.00	0.	-0.00	-0.00	-0.	-0.00	-0.00
230.	30.00	86.01	280.	34.00	40.00	0.	-0.00	-0.00	-0.	-0.00	-0.00
231.	32.85	80.70	281.	34.00	40.00	0.	-0.00	-0.00	-0.	-0.00	-0.00
232.	32.86	100.00	282.	34.00	36.25	0.	-0.00	-0.00	-0.	-0.00	-0.00
233.	33.37	100.00	283.	38.26	24.68	0.	-0.00	-0.00	-0.	-0.00	-0.00
234.	36.00	100.00	284.	43.38	61.38	0.	-0.00	-0.00	-0.	-0.00	-0.00
235.	51.77	100.00	285.	50.78	46.12	0.	-0.00	-0.00	-0.	-0.00	-0.00
236.	60.57	75.72	286.	52.00	19.92	0.	-0.00	-0.00	-0.	-0.00	-0.00
237.	64.00	70.00	287.	52.32	0.0	0.	-0.00	-0.00	-0.	-0.00	-0.00
238.	64.91	70.00	288.	52.09	3.19	0.	-0.00	-0.00	-0.	-0.00	-0.00
239.	75.83	70.00	289.	48.00	10.00	0.	-0.00	-0.00	-0.	-0.00	-0.00
240.	82.00	70.00	290.	48.00	10.00	0.	-0.00	-0.00	-0.	-0.00	-0.00
241.	85.72	51.42	291.	48.00	10.00	0.	-0.00	-0.00	-0.	-0.00	-0.00
242.	86.17	49.14	292.	30.94	19.48	0.	-0.00	-0.00	-0.	-0.00	-0.00
243.	88.49	35.13	293.	28.00	20.00	0.	-0.00	-0.00	-0.	-0.00	-0.00
244.	90.00	15.99	294.	28.00	20.00	0.	-0.00	-0.00	-0.	-0.00	-0.00
245.	91.12	26.74	295.	28.00	15.81	0.	-0.00	-0.00	-0.	-0.00	-0.00
246.	92.00	32.85	296.	28.00	10.00	0.	-0.00	-0.00	-0.	-0.00	-0.00
247.	93.74	30.00	297.	26.53	10.00	0.	-0.00	-0.00	-0.	-0.00	-0.00
248.	89.29	MOTRING	298.	26.00	10.00	0.	-0.00	-0.00	-0.	-0.00	-0.00
249.	66.00	41.87	299.	23.71	MOTRING	0.	-0.00	-0.00	-0.	-0.00	-0.00

CYCLE # 296 644 805
LOS ANGELES - All Gasoline
FREEWAY

SECONDS	% RPM	% POWER	SEC	% RPM	% POWER	SEC	% RPM	% POWER	SEC	% RPM	% POWER
0.	0.0	0.0	50.	48.26	90.00	100.	60.00	92.60	150.	80.00	-999.99
1.	0.0	0.0	51.	48.00	89.73	101.	60.00	90.00	151.	80.00	-999.99
2.	0.0	0.0	52.	48.37	80.00	102.	60.00	90.00	152.	80.00	63.93
3.	0.0	0.0	53.	49.32	80.00	103.	60.42	90.00	153.	84.00	80.00
4.	1.26	25.19	54.	48.00	80.00	104.	62.74	90.00	154.	85.43	82.39
5.	6.72	47.87	55.	48.00	80.00	105.	65.05	90.00	155.	87.62	93.96
6.	13.67	40.56	56.	48.00	80.00	106.	66.00	83.16	156.	84.00	100.00
7.	16.20	80.00	57.	48.00	70.28	107.	66.00	71.59	157.	84.00	100.00
8.	18.52	80.00	58.	48.00	70.00	108.	66.00	70.00	158.	84.00	91.32
9.	25.83	75.83	59.	48.00	70.00	109.	66.00	70.00	159.	86.00	100.00
10.	35.15	70.00	60.	48.00	74.44	110.	66.00	73.14	160.	86.73	100.00
11.	39.93	77.31	61.	48.00	61.96	111.	66.00	80.00	161.	90.00	96.59
12.	41.78	80.00	62.	49.52	50.00	112.	66.00	86.28	162.	91.99	90.00
13.	40.00	10.00	63.	50.00	50.00	113.	66.00	90.00	163.	94.00	90.00
14.	40.00	20.18	64.	50.00	40.00	114.	66.00	90.00	164.	95.63	81.87
15.	40.00	52.78	65.	50.00	44.62	115.	68.20	100.00	165.	96.00	89.70
16.	40.00	34.82	66.	50.78	60.00	116.	70.00	100.00	166.	100.00	98.72
17.	40.00	30.00	67.	52.00	49.09	117.	70.00	100.00	167.	100.57	78.60
18.	40.00	39.33	68.	52.00	40.00	118.	70.00	100.00	168.	102.88	50.00
19.	40.00	30.09	69.	52.00	40.00	119.	74.38	100.00	169.	104.00	73.99
20.	38.30	100.00	70.	52.04	40.89	120.	76.00	100.00	170.	104.00	90.00
21.	40.61	100.00	71.	54.00	90.00	121.	72.09	100.00	171.	104.00	25.98
22.	42.00	100.00	72.	54.00	90.00	122.	73.60	100.00	172.	103.71	20.00
23.	42.00	100.00	73.	54.00	85.10	123.	72.00	100.00	173.	99.54	20.00
24.	42.00	100.00	74.	55.29	73.53	124.	72.00	100.00	174.	98.00	20.00
25.	42.00	100.00	75.	56.00	70.00	125.	72.00	100.00	175.	99.09	25.44
26.	42.00	100.00	76.	56.00	70.00	126.	72.00	100.00	176.	98.60	65.08
27.	42.50	97.50	77.	56.00	60.00	127.	72.00	100.00	177.	103.15	80.00
28.	43.19	85.93	78.	56.00	57.23	128.	72.29	100.00	178.	100.03	80.00
29.	43.13	85.65	79.	56.00	50.00	129.	73.39	100.00	179.	102.35	80.00
30.	44.00	90.00	80.	56.00	38.17	130.	72.92	100.00	180.	104.00	73.38
31.	44.00	90.00	81.	56.00	30.00	131.	74.00	100.00	181.	104.00	55.11
32.	44.00	80.00	82.	56.00	30.00	132.	74.00	100.00	182.	101.42	30.62
33.	44.00	80.00	83.	54.00	39.36	133.	77.73	100.00	183.	98.39	11.97
34.	44.70	80.00	84.	54.00	27.79	134.	78.00	100.00	184.	57.65	-999.99
35.	46.00	74.91	85.	54.00	20.00	135.	77.50	100.00	185.	58.00	-999.99
36.	46.00	63.34	86.	54.00	20.00	136.	76.00	100.00	186.	57.45	-999.99
37.	46.00	60.00	87.	54.00	20.00	137.	76.00	100.00	187.	56.00	-999.99
38.	46.00	60.00	88.	54.00	11.49	138.	76.00	100.00	188.	56.00	-999.99
39.	44.00	10.00	89.	54.00	0.08	139.	72.49	100.00	189.	56.00	27.39
40.	44.00	10.00	90.	54.00	13.31	140.	71.79	100.00	190.	56.00	40.00
41.	43.09	10.00	91.	54.00	30.00	141.	67.16	100.00	191.	56.00	50.00
42.	42.00	10.00	92.	54.96	30.00	142.	72.70	100.00	192.	56.00	45.60
43.	42.00	10.00	93.	57.28	30.00	143.	75.02	100.00	193.	56.00	33.77
44.	43.85	19.26	94.	56.41	30.00	144.	73.34	100.00	194.	56.00	40.00
45.	50.00	90.00	95.	57.91	30.00	145.	73.64	91.78	195.	60.15	5.40
46.	50.00	90.00	96.	58.22	36.60	146.	74.00	31.21	196.	62.00	-999.99
47.	50.00	90.00	97.	60.00	90.00	147.	78.27	28.63	197.	62.00	-999.99
48.	50.00	90.00	98.	60.00	90.00	148.	80.00	17.05	198.	62.00	41.64
49.	50.00	90.00	99.	60.00	95.82	149.	80.00	5.48	199.	62.00	59.65

CYCLE #296 644 805

(Page 2)

SEC	% RPM	% POWER	SEC	% RPM	% POWER	SEC	% RPM	% POWER
200.	62.00	75.21	250.	68.00	70.00	300.	58.66	67.95
201.	62.00	76.36	251.	69.00	70.00	301.	37.27	60.00
202.	62.00	80.00	252.	70.00	70.00	302.	34.96	60.00
203.	62.00	80.00	253.	70.00	70.00	303.	32.65	73.54
204.	62.00	80.00	254.	70.00	70.00	304.	30.33	80.00
205.	62.00	80.00	255.	70.00	70.00	305.	28.02	80.00
206.	61.15	80.00	256.	70.00	70.00	306.	25.70	50.00
207.	60.00	80.00	257.	70.00	70.00	307.	23.39	37.76
208.	60.00	87.38	258.	73.61	70.00	308.	21.07	10.00
209.	60.00	90.00	259.	76.00	62.41	309.	18.76	10.00
210.	60.00	90.00	260.	76.00	60.00	310.	14.89	MOTORING
211.	60.00	90.00	261.	76.00	100.00	311.	12.13	MOTORING
212.	60.00	90.00	262.	76.92	100.00	312.	5.45	MOTORING
213.	60.00	90.00	263.	80.78	100.00	313.	0.0	0.0
214.	60.00	83.17	264.	82.00	100.00	314.	0.0	0.0
215.	60.00	80.00	265.	83.40	100.00	315.	0.0	0.0
216.	60.00	89.97	266.	84.00	100.00	316.	0.0	0.0
217.	62.31	90.00	267.	83.97	90.00			
218.	64.00	86.88	268.	82.35	90.00			
219.	64.00	80.00	269.	85.33	93.31			
220.	64.00	80.00	270.	89.95	100.00			
221.	64.00	80.00	271.	88.13	100.00			
222.	64.00	80.00	272.	89.21	100.00			
223.	66.00	70.00	273.	95.76	100.00			
224.	66.51	70.00	274.	100.23	100.00			
225.	68.00	65.87	275.	102.00	100.00			
226.	68.00	60.00	276.	104.59	100.00			
227.	69.00	60.00	277.	112.71	100.00			
228.	73.31	86.55	278.	113.01	100.00			
229.	74.00	90.00	279.	112.00	100.00			
230.	74.00	90.00	280.	104.00	MOTORING			
231.	73.29	90.00	281.	103.56	MOTORING			
232.	72.00	84.86	282.	102.75	MOTORING			
233.	73.34	73.29	283.	102.94	MOTORING			
234.	74.00	70.00	284.	99.24	MOTORING			
235.	72.03	70.00	285.	94.61	MOTORING			
236.	71.71	50.00	286.	93.99	MOTORING			
237.	70.00	50.00	287.	92.32	MOTORING			
238.	70.00	50.00	288.	93.36	MOTORING			
239.	68.77	56.15	289.	92.00	MOTORING			
240.	68.00	60.00	290.	90.73	MOTORING			
241.	68.00	60.00	291.	88.42	MOTORING			
242.	68.00	58.28	292.	84.21	MOTORING			
243.	68.00	40.00	293.	82.00	10.00			
244.	68.00	48.01	294.	82.00	7.38			
245.	68.00	60.00	295.	82.00	MOTORING			
246.	69.00	60.00	296.	82.00	MOTORING			
247.	68.00	60.00	297.	68.79	48.69			
248.	68.00	60.00	298.	64.00	70.00			
249.	68.00	61.87	299.	64.00	70.00			

CYCLE # 211024 8101

LOS ANGELES - All Diesel

NON-FREZWAY

SEC	% RPM	% POWER	SEC	% RPM	% POWER	SEC	% RPM	% POWER	SEC	% RPM	% POWER
0.	0.0	0.0	50.	0.0	0.0	100.	78.35	49.17	150.	96.00	-999.99
1.	0.0	0.0	51.	0.0	0.0	101.	82.00	70.00	151.	85.27	28.34
2.	0.0	0.0	52.	0.0	0.0	102.	80.65	69.46	152.	87.54	30.76
3.	0.0	0.0	53.	0.0	0.0	103.	92.85	60.00	153.	86.16	29.18
4.	0.0	0.0	54.	0.0	0.0	104.	97.48	60.00	154.	88.00	20.00
5.	0.0	0.0	55.	0.0	0.0	105.	98.95	60.00	155.	87.21	20.00
6.	0.0	0.0	56.	0.0	0.0	106.	100.74	60.00	156.	86.00	20.00
7.	0.0	0.0	57.	0.0	0.0	107.	103.68	43.17	157.	87.42	20.00
8.	0.0	0.0	58.	0.0	0.0	108.	104.00	10.04	158.	88.00	11.32
9.	0.0	0.0	59.	0.0	0.0	109.	80.62	20.00	159.	77.84	-999.99
10.	0.0	0.0	60.	0.0	0.0	110.	83.37	20.00	160.	72.00	-999.99
11.	0.0	0.0	61.	0.0	0.0	111.	81.06	15.29	161.	71.32	-999.99
12.	0.0	0.0	62.	0.0	0.0	112.	80.00	10.00	162.	70.00	0.04
13.	0.0	0.0	63.	0.0	0.0	113.	76.86	MOTORING	163.	70.00	-999.99
14.	0.0	0.0	64.	0.0	0.0	114.	74.11	MOTORING	164.	74.88	-999.99
15.	0.0	0.0	65.	0.0	0.0	115.	71.60	MOTORING	165.	74.06	-999.99
16.	0.0	0.0	66.	0.0	0.0	116.	70.58	MOTORING	166.	67.74	-999.99
17.	0.0	0.0	67.	0.0	0.0	117.	78.00	MOTORING	167.	66.00	-999.99
18.	0.0	0.0	68.	0.0	0.0	118.	80.29	1.45	168.	64.23	-999.99
19.	0.0	0.0	69.	0.0	0.0	119.	80.54	17.30	169.	62.00	-999.99
20.	0.0	0.0	70.	0.0	0.0	120.	78.23	11.13	170.	55.94	-999.99
21.	0.0	0.0	71.	0.0	0.0	121.	78.45	19.55	171.	54.00	-999.99
22.	0.0	0.0	72.	0.0	0.0	122.	84.36	24.16	172.	66.43	-999.99
23.	0.0	0.0	73.	0.0	0.0	123.	72.16	80.00	173.	75.21	70.00
24.	0.0	15.55	74.	0.0	0.0	124.	79.10	74.83	174.	86.00	54.53
25.	0.0	20.00	75.	0.0	0.0	125.	90.09	16.04	175.	86.00	24.56
26.	24.18	19.08	76.	0.0	0.0	126.	74.04	MOTORING	176.	88.81	-999.99
27.	23.00	10.00	77.	0.0	0.0	127.	68.02	MOTORING	177.	90.00	-999.99
28.	11.56	1.86	78.	0.0	0.0	128.	68.53	MOTORING	178.	105.48	-999.99
29.	6.87	MOTORING	79.	0.0	0.0	129.	59.39	MOTORING	179.	74.00	-999.99
30.	6.00	MOTORING	80.	0.0	29.59	130.	63.54	MOTORING	180.	73.34	-999.99
31.	0.72	MOTORING	81.	-1.50	87.46	131.	70.00	2.38	181.	71.02	10.00
32.	0.0	0.0	82.	9.88	100.00	132.	73.10	17.76	182.	76.46	29.38
33.	0.0	0.0	83.	46.04	100.00	133.	72.13	MOTORING	183.	81.61	40.00
34.	0.0	0.0	84.	76.89	100.00	134.	67.27	MOTORING	184.	78.16	30.39
35.	0.0	0.0	85.	80.00	100.00	135.	36.03	MOTORING	185.	74.13	26.46
36.	0.0	0.0	86.	82.14	94.64	136.	20.75	MOTORING	186.	90.00	0.0
37.	0.0	0.0	87.	85.39	83.07	137.	11.49	MOTORING	187.	90.87	0.0
38.	0.0	0.0	88.	87.70	88.51	138.	-2.09	MOTORING	188.	92.00	-999.99
39.	0.0	0.0	89.	92.00	79.83	139.	-0.73	MOTORING	189.	93.50	-999.99
40.	0.0	0.0	90.	92.00	61.66	140.	8.57	60.00	190.	94.00	-999.99
41.	0.0	0.0	91.	94.58	66.77	141.	30.55	61.93	191.	94.13	-999.99
42.	0.0	0.0	92.	102.88	60.00	142.	67.10	63.00	192.	88.96	-999.99
43.	0.0	0.0	93.	106.00	72.76	143.	86.03	39.85	193.	63.25	-999.99
44.	0.0	0.0	94.	109.18	8.43	144.	89.33	30.00	194.	62.00	-999.99
45.	0.0	0.0	95.	111.91	MOTORING	145.	91.64	30.00	195.	49.54	45.37
46.	0.0	0.0	96.	82.00	MOTORING	146.	97.88	10.40	196.	52.49	86.99
47.	0.0	0.0	97.	79.33	MOTORING	147.	97.73	1.37	197.	64.00	90.00
48.	0.0	0.0	98.	71.15	MOTORING	148.	96.00	10.00	198.	64.99	90.00
49.	0.0	0.0	99.	68.84	MOTORING	149.	96.00	0.96	199.	71.93	93.22

CYCLE # 211 024 810 1
(Page 2)

SEC	% RPM	% POWER	SEC	% RPM	% POWER	SEC	% RPM	% POWER
200.	73.87	95.21	250.	-0.56	MOTORING	300.	0.0	0.0
201.	82.00	83.64	251.	4.00	MOTORING	301.	0.0	0.0
202.	86.76	80.00	252.	0.68	MOTORING	302.	0.0	0.0
203.	91.71	80.00	253.	0.0	0.0	303.	0.0	0.0
204.	94.87	80.00	254.	0.0	0.0	304.	0.0	0.0
205.	103.60	80.00	255.	0.0	2.60	305.	0.0	0.0
206.	101.23	41.89	256.	0.0	20.00			
207.	95.48	24.85	257.	0.0	20.00			
208.	99.00	50.00	258.	0.0	7.96			
209.	99.79	50.00	259.	0.0	0.0			
210.	106.21	46.82	260.	0.0	0.0			
211.	110.84	MOTORING	261.	0.0	78.53			
212.	99.55	MOTORING	262.	1.85	60.00			
213.	70.95	MOTORING	263.	11.10	63.88			
214.	67.27	MOTORING	264.	16.00	70.00			
215.	60.95	MOTORING	265.	30.05	70.00			
216.	49.03	MOTORING	266.	42.88	70.00			
217.	52.31	MOTORING	267.	56.10	70.00			
218.	54.00	MOTORING	268.	63.39	66.52			
219.	65.27	MOTORING	269.	70.66	59.94			
220.	74.00	MOTORING	270.	72.98	80.00			
221.	57.61	MOTORING	271.	77.87	86.46			
222.	42.59	MOTORING	272.	88.03	90.00			
223.	38.81	MOTORING	273.	90.00	90.00			
224.	22.37	MOTORING	274.	92.23	100.00			
225.	3.52	MOTORING	275.	94.00	100.00			
226.	0.0	0.0	276.	94.86	100.00			
227.	-1.46	36.39	277.	96.00	100.00			
228.	-0.23	5.75	278.	97.49	100.00			
229.	0.0	0.0	279.	108.84	100.00			
230.	0.0	0.0	280.	110.00	93.92			
231.	0.0	0.0	281.	104.77	MOTORING			
232.	0.0	0.0	282.	97.50	MOTORING			
233.	0.0	0.0	283.	90.00	0.0			
234.	0.0	0.0	284.	91.38	MOTORING			
235.	0.0	0.0	285.	81.84	MOTORING			
236.	0.0	0.0	286.	65.99	MOTORING			
237.	0.0	0.0	287.	63.68	MOTORING			
238.	0.0	0.0	288.	60.73	MOTORING			
239.	0.0	0.0	289.	57.05	MOTORING			
240.	0.0	0.0	290.	53.47	MOTORING			
241.	0.0	0.0	291.	50.42	MOTORING			
242.	0.0	0.0	292.	44.31	MOTORING			
243.	0.0	0.0	293.	37.58	37.91			
244.	0.0	0.0	294.	33.48	20.00			
245.	0.0	0.0	295.	31.16	20.00			
246.	0.0	0.0	296.	28.85	20.00			
247.	0.0	MOTORING	297.	22.13	20.00			
248.	0.0	0.0	298.	9.31	MOTORING			
249.	-0.75	MOTORING	299.	0.0	0.0			

CYCLE # 159934 5415
Los Angeles - All Diesel
FREEWAY

SEC	% RPM	% POWER	SEC	% RPM	% POWER	SEC	% RPM	% POWER	SEC	% RPM	% POWER
0.	0.0	0.0	50.	83.00	90.00	100.	84.52	MOTURING	150.	96.00	42.19
1.	0.0	0.0	51.	90.00	90.00	101.	82.21	MOTURING	151.	96.00	42.33
2.	0.0	0.0	52.	89.63	90.00	102.	79.89	MOTURING	152.	96.00	40.00
3.	0.0	0.0	53.	88.68	90.00	103.	77.58	MOTURING	153.	96.00	38.37
4.	2.52	6.30	54.	90.00	90.00	104.	76.00	6.31	154.	96.00	12.83
5.	10.30	17.87	55.	90.00	90.00	105.	79.16	0.0	155.	96.00	-999.99
6.	13.89	20.00	56.	91.63	81.86	106.	75.16	27.36	156.	96.00	-999.99
7.	20.20	20.00	57.	92.00	80.00	107.	72.00	40.00	157.	96.00	-999.99
8.	24.07	22.59	58.	90.00	81.29	108.	72.00	40.00	158.	97.74	7.37
9.	33.33	17.50	59.	89.43	92.86	109.	74.00	38.44	159.	100.05	19.74
10.	40.30	MOTURING	60.	87.11	100.00	110.	74.00	30.00	160.	102.00	11.83
11.	47.85	MOTURING	61.	86.00	100.00	111.	74.00	30.00	161.	102.00	26.81
12.	66.00	7.78	62.	86.00	100.00	112.	74.00	36.28	162.	103.00	49.96
13.	68.00	10.93	63.	89.66	100.00	113.	72.43	47.86	163.	104.00	60.00
14.	67.59	32.04	64.	90.00	99.27	114.	68.23	59.43	164.	102.37	60.00
15.	66.07	40.00	65.	90.46	90.00	115.	73.80	50.00	165.	103.94	60.00
16.	67.04	40.00	66.	92.78	90.00	116.	72.52	50.00	166.	104.00	40.00
17.	68.00	40.00	67.	95.09	90.00	117.	74.00	45.85	167.	104.00	25.75
18.	69.00	48.33	68.	100.22	82.97	118.	72.85	57.19	168.	103.12	-999.99
19.	75.93	99.53	69.	102.00	80.00	119.	76.38	62.70	169.	100.80	-999.99
20.	79.00	100.00	70.	102.00	70.18	120.	81.55	60.00	170.	100.00	-999.99
21.	79.00	100.00	71.	102.00	80.00	121.	80.18	60.00	171.	101.83	44.88
22.	77.07	100.00	72.	97.34	50.07	122.	83.60	60.00	172.	102.00	36.40
23.	76.00	100.00	73.	87.02	MOTURING	123.	83.44	56.40	173.	102.00	-999.99
24.	76.00	100.00	74.	86.00	MOTURING	124.	86.00	50.00	174.	102.00	-999.99
25.	76.00	100.00	75.	73.12	22.19	125.	87.35	50.00	175.	100.91	-999.99
26.	75.63	100.00	76.	75.77	39.62	126.	86.34	50.00	176.	101.40	-999.99
27.	73.00	97.50	77.	75.76	48.80	127.	86.00	40.11	177.	100.28	-999.99
28.	76.81	90.00	78.	75.11	37.23	128.	80.29	61.47	178.	97.97	-999.99
29.	80.26	90.00	79.	78.00	34.34	129.	88.78	63.92	179.	96.00	-999.99
30.	83.44	90.00	80.	80.37	40.00	130.	86.92	50.00	180.	96.00	10.00
31.	84.00	98.79	81.	77.51	47.49	131.	86.76	50.00	181.	96.00	0.23
32.	84.00	100.00	82.	81.44	50.00	132.	87.55	42.24	182.	96.00	-999.99
33.	83.61	100.00	83.	82.13	39.36	133.	88.00	49.74	183.	96.00	-999.99
34.	82.00	100.00	84.	84.00	27.79	134.	86.00	50.91	184.	94.08	-999.99
35.	83.02	94.91	85.	84.00	16.21	135.	86.00	67.45	185.	78.00	-999.99
36.	86.67	90.00	86.	84.00	15.36	136.	86.00	81.88	186.	77.45	-999.99
37.	89.65	90.00	87.	85.39	26.93	137.	87.13	70.00	187.	71.67	28.96
38.	90.00	99.91	88.	86.00	30.00	138.	89.44	77.21	188.	67.18	80.00
39.	89.45	100.00	89.	86.00	30.08	139.	91.76	88.78	189.	66.50	87.48
40.	96.00	100.00	90.	85.67	40.00	140.	90.07	89.65	190.	71.43	90.00
41.	86.00	95.47	91.	84.65	40.00	141.	92.00	80.00	191.	74.13	90.00
42.	87.22	90.00	92.	86.00	35.20	142.	92.70	80.00	192.	75.56	92.20
43.	89.00	90.00	93.	87.28	30.00	143.	94.00	80.00	193.	74.75	100.00
44.	88.00	80.74	94.	89.00	22.05	144.	94.00	80.00	194.	77.07	94.65
45.	88.00	79.17	95.	86.09	MOTURING	145.	94.00	80.00	195.	79.38	83.08
46.	89.00	77.21	96.	83.78	MOTURING	146.	94.00	80.00	196.	80.00	71.51
47.	89.00	100.00	97.	81.47	MOTURING	147.	94.00	81.37	197.	80.01	69.93
48.	88.00	94.45	98.	81.70	MOTURING	148.	94.59	87.05	198.	82.33	58.36
49.	88.00	90.00	99.	85.16	MOTURING	149.	96.00	57.40	199.	84.00	50.00

CYCLE # 159 934 541 5
(Page 2)

SEC	% RPM	% POWER	SEC	% RPM	% POWER
200.	84.00	59.58	250.	100.62	13.12
201.	84.00	76.36	251.	98.00	5.01
202.	84.00	80.00	252.	96.68	10.00
203.	84.00	70.49	253.	96.00	MOTORING
204.	82.00	80.00	254.	96.00	MOTORING
205.	81.47	82.66	255.	96.00	MOTORING
206.	80.00	90.00	256.	95.43	MOTORING
207.	77.68	90.00	257.	94.00	MOTORING
208.	74.52	75.24	258.	94.00	MOTORING
209.	77.58	78.96	259.	95.52	5.18
210.	81.99	80.00	260.	97.83	MOTORING
211.	80.42	80.00	261.	98.00	MOTORING
212.	82.00	83.68	262.	98.00	MOTORING
213.	83.95	79.50	263.	97.22	MOTORING
214.	84.00	70.00	264.	96.00	6.35
215.	84.00	61.60	265.	96.00	12.98
216.	94.00	50.03	266.	96.00	10.00
217.	86.00	60.00	267.	95.93	10.00
218.	85.00	60.00	268.	92.00	10.00
219.	86.00	69.39	269.	92.00	10.00
220.	88.51	73.73	270.	92.98	14.89
221.	88.43	70.00	271.	94.00	13.54
222.	89.00	70.00	272.	90.79	42.12
223.	94.00	70.99	273.	88.08	40.40
224.	94.51	80.00	274.	86.23	30.00
225.	95.17	90.00	275.	88.00	32.75
226.	95.14	80.00	276.	87.14	44.32
227.	94.54	90.00	277.	84.82	50.00
228.	94.00	90.00	278.	82.51	50.00
229.	94.00	77.89	279.	82.00	50.00
230.	94.00	31.99	280.	82.12	40.00
231.	94.00	43.57	281.	83.13	35.64
232.	94.00	60.28	282.	80.00	20.00
233.	94.00	63.29	283.	84.26	51.95
234.	94.00	76.57	284.	86.62	66.21
235.	94.00	89.86	285.	84.31	60.00
236.	94.29	90.00	286.	81.99	9.96
237.	97.80	97.00	287.	79.35	1.61
238.	102.91	90.00	288.	75.36	19.56
239.	104.00	73.85	289.	73.05	40.00
240.	104.00	62.28	290.	70.73	9.35
241.	104.00	69.29	291.	68.42	MOTORING
242.	106.00	70.00	292.	47.15	8.95
243.	106.00	62.70	293.	35.79	10.00
244.	106.00	40.00	294.	32.95	7.38
245.	104.89	40.00	295.	29.16	MOTORING
246.	104.00	32.95	296.	16.47	MOTORING
247.	104.00	30.00	297.	2.13	MOTORING
248.	104.00	0.30	298.	0.0	0.0
249.	103.63	11.87	299.	0.0	0.0
			300.	0.0	0.0

CYCLE# 8410263
New York - all gasoline
Non-Freeway

Seconds	% RPM	% Power	Seconds	% RPM	% Power	Seconds	% RPM	% Power	Seconds	% RPM	% Power
0.	0.0	0.0	50.	0.0	0.0	100.	42.96	100.00	150.	36.00	-999.99
1.	0.0	0.0	51.	0.0	0.0	101.	45.79	100.00	151.	34.47	-999.99
2.	-2.52	6.30	52.	0.0	0.0	102.	48.11	99.46	152.	32.15	-999.99
3.	-4.22	15.28	53.	0.0	0.0	103.	50.42	90.00	153.	31.67	-999.99
4.	0.0	10.00	54.	0.0	0.0	104.	52.74	75.23	154.	28.48	13.89
5.	0.0	10.00	55.	0.0	0.0	105.	54.00	50.00	155.	32.38	90.00
6.	0.0	10.00	56.	0.0	0.0	106.	44.42	9.96	156.	36.00	90.00
7.	0.0	75.93	57.	0.0	0.0	107.	45.05	MOTORING	157.	41.69	90.00
8.	0.0	32.22	58.	0.0	0.0	108.	46.00	9.99	158.	45.74	90.00
9.	1.67	35.00	59.	0.0	0.0	109.	37.69	MOTORING	159.	49.95	80.00
10.	15.48	29.82	60.	0.0	0.0	110.	31.61	5.68	160.	49.10	80.00
11.	25.46	MOTORING	61.	0.0	0.0	111.	22.94	35.29	161.	50.59	62.97
12.	24.22	MOTORING	62.	0.0	0.0	112.	24.00	4.87	162.	45.99	34.98
13.	23.44	MOTORING	63.	0.0	0.0	113.	20.86	MOTORING	163.	42.76	7.23
14.	12.41	80.00	64.	0.0	0.0	114.	12.45	MOTORING	164.	35.12	-999.99
15.	8.94	83.61	65.	0.0	0.0	115.	6.00	MOTORING	165.	32.06	67.92
16.	7.26	84.82	66.	0.0	0.0	116.	6.52	MOTORING	166.	35.53	62.55
17.	16.70	80.00	67.	0.0	0.0	117.	7.17	MOTORING	167.	46.57	68.60
18.	24.67	63.33	68.	0.0	0.0	118.	2.56	MOTORING	168.	49.77	48.85
19.	0.24	79.81	69.	0.0	0.0	119.	0.0	0.0	169.	52.00	60.00
20.	0.0	8.52	70.	0.0	0.0	120.	0.0	0.0	170.	58.06	60.00
21.	0.0	0.0	71.	0.0	0.0	121.	0.0	0.0	171.	63.66	23.42
22.	0.0	0.0	72.	0.0	0.0	122.	0.0	10.11	172.	64.14	17.84
23.	0.0	0.0	73.	0.0	0.0	123.	4.32	46.40	173.	59.58	3.76
24.	0.0	0.0	74.	0.0	0.0	124.	9.90	45.17	174.	38.00	42.26
25.	0.0	0.0	75.	0.0	0.0	125.	1.95	50.00	175.	39.09	30.00
26.	0.0	0.0	76.	0.0	0.0	126.	3.33	41.69	176.	40.00	30.00
27.	0.0	0.0	77.	0.0	0.0	127.	4.00	89.46	177.	34.85	47.18
28.	0.0	0.0	78.	0.0	0.0	128.	13.76	55.60	178.	32.03	10.33
29.	0.0	0.0	79.	0.0	0.0	129.	26.43	26.96	179.	34.00	33.48
30.	0.0	0.0	80.	0.0	0.0	130.	33.85	6.16	180.	34.00	50.00
31.	0.0	17.59	81.	0.0	0.0	131.	36.00	MOTORING	181.	33.02	20.69
32.	0.0	19.63	82.	0.0	0.0	132.	34.45	MOTORING	182.	25.54	-999.99
33.	0.0	10.00	83.	0.0	0.0	133.	34.00	MOTORING	183.	15.57	-999.99
34.	0.0	10.00	84.	0.0	0.0	134.	35.64	MOTORING	184.	14.00	-999.99
35.	0.0	10.00	85.	0.0	0.0	135.	32.99	27.39	185.	14.47	27.64
36.	0.0	3.34	86.	0.0	0.0	136.	36.00	80.00	186.	18.00	4.49
37.	0.0	0.0	87.	0.0	0.0	137.	41.63	74.37	187.	17.13	-999.99
38.	0.0	0.0	88.	0.0	0.0	138.	60.41	26.76	188.	16.00	-999.99
39.	0.0	0.0	89.	0.0	0.0	139.	48.44	MOTORING	189.	10.02	-999.99
40.	0.0	0.0	90.	0.0	0.0	140.	43.86	MOTORING	190.	9.81	-999.99
41.	0.0	0.0	91.	0.0	0.0	141.	40.39	MOTORING	191.	5.88	-999.99
42.	0.0	0.0	92.	0.0	0.0	142.	38.50	4.01	192.	4.00	-999.99
43.	0.0	0.0	93.	0.0	0.0	143.	35.05	30.00	193.	4.00	-999.99
44.	0.0	0.0	94.	0.0	0.0	144.	40.66	16.70	194.	2.93	-999.99
45.	0.0	0.0	95.	0.0	0.0	145.	43.64	26.45	195.	0.62	-999.99
46.	0.0	0.0	96.	-1.78	44.40	146.	45.96	MOTORING	196.	0.0	-999.99
47.	0.0	0.0	97.	0.0	85.35	147.	47.10	MOTORING	197.	0.0	-999.99
48.	0.0	0.0	98.	4.25	100.00	148.	49.29	MOTORING	198.	0.0	-999.99
49.	0.0	0.0	99.	27.47	100.00	149.	37.10	MOTORING	199.	0.0	-999.99

CYCLE # 8410263

(PAGE 2)

SECONDS	% RPM	% POWER	SECONDS	% RPM	% POWER						
200.	0.0	MOTORING	250.	9.31	MOTORING	-0.	-0.00	-0.00	-0.	-0.00	-0.00
201.	0.0	10.00	251.	3.99	MOTORING	-0.	-0.00	-0.00	-0.	-0.00	-0.00
202.	0.0	10.00	252.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
203.	0.0	29.02	253.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
204.	0.0	27.83	254.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
205.	0.0	7.34	255.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
206.	0.0	0.0	256.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
207.	0.0	0.0	257.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
208.	0.0	0.0	258.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
209.	0.0	0.0	259.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
210.	0.0	0.0	260.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
211.	0.0	0.0	261.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
212.	0.0	0.0	262.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
213.	0.0	0.0	263.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
214.	0.0	0.0	264.	0.0	MOTORING	-0.	-0.00	-0.00	-0.	-0.00	-0.00
215.	0.0	0.0	265.	0.0	MOTORING	-0.	-0.00	-0.00	-0.	-0.00	-0.00
216.	0.0	0.0	266.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
217.	2.00	0.0	267.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
218.	1.39	0.0	268.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
219.	0.0	0.0	269.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
220.	0.0	6.27	270.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
221.	0.0	2.16	271.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
222.	0.0	0.0	272.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
223.	0.0	0.0				-0.	-0.00	-0.00	-0.	-0.00	-0.00
224.	0.0	0.0				-0.	-0.00	-0.00	-0.	-0.00	-0.00
225.	0.93	MOTORING				-0.	-0.00	-0.00	-0.	-0.00	-0.00
226.	2.00	MOTORING				-0.	-0.00	-0.00	-0.	-0.00	-0.00
227.	0.54	MOTORING				-0.	-0.00	-0.00	-0.	-0.00	-0.00
228.	0.0	MOTORING				-0.	-0.00	-0.00	-0.	-0.00	-0.00
229.	0.0	MOTORING				-0.	-0.00	-0.00	-0.	-0.00	-0.00
230.	0.0	MOTORING				-0.	-0.00	-0.00	-0.	-0.00	-0.00
231.	0.0	MOTORING				-0.	-0.00	-0.00	-0.	-0.00	-0.00
232.	0.0	0.0				-0.	-0.00	-0.00	-0.	-0.00	-0.00
233.	0.0	0.0				-0.	-0.00	-0.00	-0.	-0.00	-0.00
234.	0.0	0.0				-0.	-0.00	-0.00	-0.	-0.00	-0.00
235.	0.0	0.0				-0.	-0.00	-0.00	-0.	-0.00	-0.00
236.	0.0	0.0				-0.	-0.00	-0.00	-0.	-0.00	-0.00
237.	0.0	MOTORING				-0.	-0.00	-0.00	-0.	-0.00	-0.00
238.	0.0	22.01				-0.	-0.00	-0.00	-0.	-0.00	-0.00
239.	1.23	72.29				-0.	-0.00	-0.00	-0.	-0.00	-0.00
240.	6.63	90.00				-0.	-0.00	-0.00	-0.	-0.00	-0.00
241.	17.29	99.29				-0.	-0.00	-0.00	-0.	-0.00	-0.00
242.	22.17	90.00				-0.	-0.00	-0.00	-0.	-0.00	-0.00
243.	24.00	82.70				-0.	-0.00	-0.00	-0.	-0.00	-0.00
244.	24.00	31.96				-0.	-0.00	-0.00	-0.	-0.00	-0.00
245.	24.00	MOTORING				-0.	-0.00	-0.00	-0.	-0.00	-0.00
246.	22.57	MOTORING				-0.	-0.00	-0.00	-0.	-0.00	-0.00
247.	22.00	MOTORING				-0.	-0.00	-0.00	-0.	-0.00	-0.00
248.	13.88	MOTORING				-0.	-0.00	-0.00	-0.	-0.00	-0.00
249.	10.00	MOTORING				-0.	-0.00	-0.00	-0.	-0.00	-0.00

CYCLE #792043535

New York - All Gasoline
FREEWAYNOTE: SEE THE ADDENDUM TO
THIS REPORT FOR EXPLANATION
OF DELETION

SECOND	% RPM	% POWER	SECOND	% RPM	% POWER	SECOND	% RPM	% POWER	SECOND	% RPM	% POWER
0.	0.0	0.0	50.	50.00	60.00	100.	66.52	87.40	150.	150.00	30.00
1.	0.0	0.0	51.	50.00	60.00	101.	66.00	98.97	151.	130.87	-999.99
2.	0.0	0.0	52.	50.00	60.00	102.	67.89	100.00	152.	120.30	-999.99
3.	0.0	0.0	53.	50.00	49.74	103.	66.00	100.00	153.	120.00	-999.99
4.	0.0	0.0	54.	50.00	30.00	104.	66.00	100.00	154.	121.91	80.00
5.	0.0	0.0	55.	50.00	23.43	105.	66.00	100.00	155.	130.38	80.00
6.	0.0	0.0	56.	50.00	20.00	106.	66.00	100.00	156.	135.11	85.54
7.	0.0	0.0	57.	50.00	0.57	107.	67.68	91.59	157.	138.84	90.00
8.	0.0	0.0	58.	50.00	MOTORING	108.	68.00	90.00	158.	140.00	90.00
9.	0.0	0.0	59.	50.00	62.86	109.	70.00	80.00	159.	139.95	87.67
10.	0.0	0.0	60.	50.00	65.56	110.	70.00	76.86	160.	137.27	-999.99
11.	0.0	0.0	61.	50.00	47.98	111.	70.00	70.00	161.	131.96	-999.99
12.	0.0	0.0	62.	53.03	40.00	112.	70.00	70.00	162.	128.00	-999.99
13.	0.0	0.0	63.	54.00	21.63	113.	70.00	77.86	163.	126.69	-999.99
14.	0.0	0.0	64.	54.15	21.47	114.	71.89	70.57	164.	124.37	71.29
15.	1.44	0.0	65.	56.00	42.31	115.	72.00	67.99	165.	125.94	99.70
16.	8.15	10.37	66.	56.00	46.12	116.	72.00	57.74	166.	82.00	91.28
17.	14.70	20.00	67.	56.00	50.91	117.	72.00	67.58	167.	82.57	100.00
18.	21.00	20.00	68.	56.00	52.97	118.	70.85	15.64	168.	86.65	100.00
19.	23.98	10.09	69.	56.00	41.40	119.	68.54	MOTORING	169.	90.00	100.00
20.	26.30	4.81	70.	58.00	20.53	120.	68.00	MOTORING	170.	90.00	100.00
21.	29.93	90.00	71.	58.00	50.00	121.	67.91	MOTORING	171.	93.66	100.00
22.	35.85	90.00	72.	58.00	46.67	122.	66.00	MOTORING	172.	94.00	92.08
23.	39.24	90.00	73.	58.00	44.90	123.	65.28	11.58	173.	94.00	-999.99
24.	40.00	82.22	74.	58.00	43.53	124.	64.00	44.83	174.	94.77	-999.99
25.	40.00	80.00	75.	58.00	40.00	125.	64.00	26.51	175.	96.00	-999.99
26.	40.18	80.00	76.	58.00	40.00	126.	64.00	11.68	176.	94.60	-999.99
27.	42.00	80.00	77.	60.24	40.00	127.	64.00	0.11	177.	92.28	-999.99
28.	42.81	80.00	78.	61.45	40.00	128.	62.88	MOTORING	178.	91.57	-999.99
29.	44.00	63.06	79.	60.00	44.34	129.	68.00	46.96	179.	66.00	70.00
30.	44.00	71.66	80.	50.82	14.50	130.	69.85	35.39	180.	64.68	70.00
31.	44.00	80.00	81.	56.50	MOTORING	131.	73.24	30.00	181.	62.98	50.46
32.	44.00	90.00	82.	57.81	MOTORING	132.	74.00	30.00	182.	64.00	23.54
33.	43.61	86.12	83.	58.00	MOTORING	133.	75.87	48.67	183.	64.00	-999.99
34.	42.00	70.00	84.	57.11	MOTORING	134.	78.18	50.91	184.	62.08	-999.99
35.	42.00	59.82	85.	54.00	MOTORING	135.	80.00	42.61	185.	33.05	-999.99
36.	42.00	43.34	86.	52.93	6.08	136.	79.19	2.17	186.	25.45	-999.99
37.	43.65	31.76	87.	52.00	33.87	137.	78.00	31.26	187.	20.54	-999.99
38.	44.00	33.81	88.	53.70	65.53	138.	80.88	25.59	188.	12.46	-999.99
39.	44.00	40.00	89.	56.00	60.00	139.	82.00	28.78	189.	7.01	-999.99
40.	44.59	45.92	90.	56.00	60.00	140.	122.00	39.65	190.	2.38	-999.99
41.	46.00	46.40	91.	56.00	47.08	141.	122.38	39.64	191.	2.00	0.0
42.	46.00	36.11	92.	56.00	20.00	142.	124.00	76.50	192.	2.44	15.39
43.	46.00	47.68	93.	57.28	32.76	143.	124.00	70.00	193.	4.75	70.00
44.	46.00	50.00	94.	58.00	40.00	144.	124.00	70.00	194.	15.62	70.00
45.	48.00	49.17	95.	58.00	40.00	145.	128.93	70.00	195.	24.00	63.08
46.	49.00	35.19	96.	60.22	80.00	146.	145.68	70.00	196.	25.70	60.00
47.	49.00	20.00	97.	63.07	77.33	147.	146.55	63.14	197.	26.00	59.93
48.	49.11	36.65	98.	66.00	70.00	148.	150.00	22.95	198.	26.00	54.93
49.	50.00	57.12	99.	67.16	75.82	149.	150.00	30.00	199.	26.00	70.35

CYCLE #792043 535

(Page 2)

SECOND	% RPM	% POWER	SECONDS	% RPM	% POWER
200.	26.96	50.00	250.	30.62	MOTORING
201.	29.27	50.00	251.	29.00	MOTORING
202.	30.00	50.00	252.	28.68	MOTORING
203.	30.00	40.49	253.	24.74	14.47
204.	34.22	18.91	254.	24.00	10.27
205.	35.47	10.00	255.	24.00	8.70
206.	34.00	5.77	256.	24.00	0.0
207.	36.32	MOTORING	257.	23.11	MOTORING
208.	32.09	4.76	258.	19.59	MOTORING
209.	30.00	1.04	259.	13.45	MOTORING
210.	32.74	90.00	260.	2.84	72.46
211.	46.00	90.00	261.	5.56	77.80
212.	45.26	93.68	262.	0.0	47.69
213.	42.95	100.00	263.	0.78	47.76
214.	43.37	100.00	264.	2.00	21.84
215.	45.68	100.00	265.	2.00	MOTORING
216.	46.00	100.00	266.	2.00	MOTORING
217.	44.00	100.00	267.	0.0	0.0
218.	44.62	96.88	268.	0.0	0.0
219.	54.45	43.05	269.	0.0	0.0
220.	65.25	MOTORING	270.	0.0	0.0
221.	66.00	MOTORING	271.	0.0	0.0
222.	64.12	MOTORING	272.	0.0	0.0
223.	60.00	MOTORING	273.	0.0	0.0
224.	59.49	12.32	274.	0.0	0.0
225.	59.00	MOTORING	275.	0.0	0.0
226.	58.00	MOTORING	276.	0.0	0.0
227.	58.00	MOTORING	277.	0.0	0.0
228.	58.00	MOTORING	278.	0.0	0.0
229.	59.59	MOTORING	279.	0.0	0.0
230.	20.00	30.00	280.	0.0	0.0
231.	20.71	37.90	281.	0.0	0.0
232.	23.03	24.86	282.	0.0	0.0
233.	25.34	40.13	283.	0.0	0.0
234.	24.34	74.85	284.	0.0	0.0
235.	24.00	40.58	285.	0.0	0.0
236.	24.00	70.00	286.	-0.00	-0.00
237.	24.00	70.00	287.	-0.00	-0.00
238.	24.91	65.43	288.	-0.00	-0.00
239.	26.00	66.15	289.	-0.00	-0.00
240.	29.09	62.28	290.	-0.00	-0.00
241.	31.96	87.87	291.	-0.00	-0.00
242.	30.00	90.00	292.	-0.00	-0.00
243.	30.97	90.00	293.	-0.00	-0.00
244.	34.00	90.00	294.	-0.00	-0.00
245.	34.00	90.00	295.	-0.00	-0.00
246.	34.00	90.00	296.	-0.00	-0.00
247.	34.00	46.38	297.	-0.00	-0.00
248.	32.06	20.00	298.	-0.00	-0.00
249.	33.63	14.40	299.	-0.00	-0.00

CYCLE # 211 414 744 7

NEW YORK - All Diesel

NON-FREZWAY

SEC	% RPM	% POWER	SEC	% RPM	% POWER	SEC	% RPM	% POWER	SEC	% RPM	% POWER
0.	0.0	0.0	50.	0.0	0.0	100.	78.00	MOTORING	150.	0.0	0.0
1.	0.0	0.0	51.	0.0	0.0	101.	79.79	MOTOBING	151.	0.0	0.0
2.	0.0	0.0	52.	0.0	0.0	102.	80.33	30.54	152.	0.0	0.0
3.	0.0	0.0	53.	0.0	0.0	103.	85.58	42.12	153.	0.0	0.0
4.	0.0	0.0	54.	0.0	24.97	104.	81.78	50.00	154.	0.0	0.0
5.	0.0	0.0	55.	0.0	17.16	105.	78.00	50.00	155.	0.0	0.0
6.	0.0	0.0	56.	0.0	0.0	106.	80.74	43.16	156.	0.0	0.0
7.	0.0	0.0	57.	0.0	0.0	107.	92.10	73.65	157.	0.0	0.0
8.	0.0	0.0	58.	0.0	0.0	108.	88.01	MOTORING	158.	0.0	0.0
9.	0.0	0.0	59.	0.0	0.0	109.	84.00	MOTORING	159.	0.0	0.0
10.	0.0	0.0	60.	0.0	0.0	110.	84.00	MOTORING	160.	0.0	0.0
11.	0.0	0.0	61.	0.0	0.0	111.	81.17	MOTORING	161.	0.0	0.0
12.	0.0	0.0	62.	0.0	0.0	112.	70.46	MOTORING	162.	0.0	0.0
13.	0.0	0.0	63.	0.0	0.0	113.	66.00	13.57	163.	0.0	0.0
14.	0.0	0.0	64.	0.0	3.67	114.	62.23	29.43	164.	0.0	0.0
15.	0.0	0.0	65.	0.0	47.69	115.	64.00	20.00	165.	0.0	0.0
16.	0.0	0.0	66.	3.11	59.41	116.	63.48	17.42	166.	0.0	0.0
17.	0.0	0.0	67.	9.09	84.54	117.	60.34	10.00	167.	0.0	0.0
18.	0.0	0.0	68.	15.62	80.00	118.	56.85	10.00	168.	1.77	-999.99
19.	0.0	0.0	69.	33.49	80.00	119.	56.00	MOTORING	169.	1.60	-999.99
20.	0.0	0.0	70.	37.93	79.29	120.	52.45	MOTORING	170.	0.0	-999.99
21.	0.0	0.0	71.	31.20	38.25	121.	39.91	10.00	171.	0.0	0.0
22.	0.0	0.0	72.	21.99	26.67	122.	36.38	10.00	172.	2.14	9.28
23.	0.0	6.20	73.	30.00	15.10	123.	30.00	10.00	173.	3.08	0.0
24.	0.0	10.00	74.	22.23	16.47	124.	27.93	10.00	174.	0.0	0.0
25.	0.0	10.00	75.	19.61	28.05	125.	26.00	16.74	175.	0.0	0.0
26.	0.0	0.0	76.	20.00	20.38	126.	27.66	3.36	176.	0.0	0.0
27.	0.0	0.0	77.	19.33	MOTORING	127.	28.00	MOTORING	177.	0.0	0.0
28.	0.0	0.0	78.	6.55	MOTORING	128.	27.41	MOTORING	178.	0.0	0.0
29.	0.0	0.0	79.	15.82	MOTORING	129.	20.96	MOTORING	179.	0.0	0.0
30.	0.0	0.0	80.	23.63	MOTORING	130.	12.15	MOTORING	180.	0.0	0.0
31.	0.0	0.0	81.	17.51	MOTORING	131.	3.81	MOTORING	181.	0.0	0.0
32.	0.0	0.0	82.	14.19	62.52	132.	0.0	MOTORING	182.	0.0	0.0
33.	0.0	0.0	83.	16.64	69.36	133.	0.0	MOTOBING	183.	0.0	0.0
34.	0.0	0.0	84.	27.77	60.00	134.	0.0	0.91	184.	0.0	0.0
35.	0.0	0.0	85.	37.03	63.79	135.	0.0	7.52	185.	0.0	0.0
36.	0.0	0.0	86.	47.36	75.36	136.	0.0	0.0	186.	0.0	5.51
37.	0.0	0.0	87.	54.77	80.00	137.	0.0	0.0	187.	0.0	11.34
38.	0.0	0.0	88.	57.70	80.00	138.	0.0	0.0	188.	0.0	0.0
39.	0.0	0.0	89.	54.03	79.92	139.	0.0	0.0	189.	0.0	0.0
40.	0.0	0.0	90.	58.00	65.03	140.	0.0	0.0	190.	0.0	0.0
41.	0.0	0.0	91.	58.65	43.23	141.	0.0	0.0	191.	0.0	0.0
42.	0.0	0.0	92.	62.88	50.00	142.	0.0	0.0	192.	0.0	0.0
43.	0.0	0.0	93.	69.83	50.00	143.	0.0	0.0	193.	0.0	0.0
44.	0.0	0.0	94.	72.00	42.05	144.	0.0	0.0	194.	0.0	0.0
45.	0.0	0.0	95.	75.81	40.00	145.	0.0	0.0	195.	0.0	0.0
46.	0.0	0.0	96.	84.22	42.20	146.	0.0	0.0	196.	0.0	0.0
47.	0.0	0.0	97.	83.86	41.28	147.	0.0	0.0	197.	0.0	0.21
48.	0.0	0.0	98.	80.55	MOTORING	148.	0.0	0.0	198.	0.0	30.00
49.	0.0	0.0	99.	80.51	MOTORING	149.	0.0	0.0	199.	0.0	26.78

CYCLE # 211 414 744 7
 New York - All Diesel
 NON FREEWAY
 (PAGE 2)

SEZ	% RPM	To POWER	SEZ	% RPM	To POWER
201.	0.0	20.00	250.	0.0	0.0
201.	0.0	20.00	251.	0.0	0.0
202.	0.0	4.12	252.	0.0	0.0
203.	0.0	0.0	253.	0.0	73.41
204.	0.0	0.0	254.	0.0	90.00
205.	0.0	0.0	255.	31.30	81.30
206.	0.0	0.0	256.	41.15	90.00
207.	0.0	0.0	257.	44.00	90.00
208.	0.0	0.0	258.	46.41	90.00
209.	0.0	0.0	259.	51.04	82.41
210.	0.0	0.0	260.	66.66	80.00
211.	0.0	0.0	261.	75.03	90.00
212.	0.0	0.0	262.	89.85	90.00
213.	0.0	0.0	263.	96.78	93.88
214.	0.0	0.0	264.	96.91	50.94
215.	0.0	0.0	265.	94.60	17.02
216.	0.0	0.0	266.	99.16	28.60
217.	0.0	0.0	267.	100.00	39.83
218.	0.0	0.0	268.	100.00	30.00
219.	0.0	0.0	269.	100.00	26.69
220.	0.0	0.0	270.	100.98	20.00
221.	0.0	0.0	271.	100.71	20.00
222.	0.0	0.0	272.	100.00	36.06
223.	0.0	20.00	273.	96.16	40.00
224.	0.0	20.00	274.	95.77	30.00
225.	0.0	11.73	275.	94.55	32.75
226.	0.0	0.0	276.	96.86	35.68
227.	0.0	0.0	277.	99.19	30.00
228.	0.0	0.0	278.	100.00	44.93
229.	0.0	0.0	279.	101.81	50.00
230.	0.0	0.0	280.	86.54	MOTURING
231.	0.0	0.0	281.	63.56	MOTURING
232.	0.0	0.0	282.	56.00	MOTURING
233.	0.0	0.0	283.	46.00	MOTURING
234.	0.0	0.0	284.	41.86	45.18
235.	0.0	0.0	285.	38.31	78.47
236.	0.0	0.0	286.	35.98	80.00
237.	0.0	0.0	287.	31.03	80.00
238.	0.0	0.0	288.	25.36	80.00
239.	0.0	0.0	289.	23.05	60.97
240.	0.0	0.0	290.	18.20	27.14
241.	0.0	0.0	291.	12.84	43.71
242.	0.0	0.0	292.	10.10	68.95
243.	0.0	0.0	293.	3.79	68.95
244.	0.0	0.0	294.	1.48	44.28
245.	0.0	0.0	295.	0.0	0.0
246.	0.0	0.0	296.	0.0	0.0
247.	0.0	0.0	297.	0.0	0.0
248.	0.0	0.0			
249.	0.0	0.0			

CYCLE #104 099 544

New York - All Diesel

FREEWAY

SEC	% RPM	% POWER	SEC	% RPM	% POWER	SEC	% RPM	% POWER	SEC	% RPM	% POWER
0.	0.0	0.0	50.	0.0	0.0	100.	98.00	90.00	150.	75.56	25.63
1.	0.0	MOTORING	51.	0.0	0.0	101.	92.21	98.97	151.	72.47	17.67
2.	0.0	MOTORING	52.	0.0	0.0	102.	90.00	99.46	152.	77.54	-999.99
3.	0.0	0.0	53.	0.0	0.0	103.	90.00	87.88	153.	72.21	-999.99
4.	0.0	0.0	54.	0.0	0.0	104.	90.00	80.00	154.	51.04	62.39
5.	0.0	0.0	55.	0.0	0.0	105.	90.00	80.00	155.	51.17	70.00
6.	0.0	0.0	56.	0.0	0.0	106.	91.37	86.84	156.	56.00	58.93
7.	0.0	0.0	57.	0.0	0.0	107.	90.32	90.00	157.	56.00	50.00
8.	0.0	0.0	58.	0.0	0.0	108.	90.00	99.99	158.	56.00	32.63
9.	0.0	0.0	59.	0.0	0.0	109.	98.31	98.44	159.	54.00	39.74
10.	0.0	0.0	60.	0.0	0.0	110.	96.00	93.14	160.	53.63	37.33
11.	0.0	0.0	61.	0.0	0.0	111.	97.88	100.00	161.	52.00	70.00
12.	0.0	0.0	62.	0.0	0.0	112.	100.00	100.00	162.	52.00	70.00
13.	0.0	0.0	63.	0.0	0.0	113.	100.00	100.00	163.	53.31	37.23
14.	0.0	0.0	64.	0.29	MOTORING	114.	101.89	100.00	164.	54.00	20.00
15.	0.0	0.0	65.	3.54	MOTORING	115.	101.80	100.00	165.	55.94	20.00
16.	0.0	MOTORING	66.	1.22	MOTORING	116.	100.00	97.42	166.	55.74	23.83
17.	0.0	MOTORING	67.	0.0	4.54	117.	100.00	90.00	167.	56.85	44.30
18.	0.0	0.0	68.	0.0	0.0	118.	98.85	95.73	168.	63.12	34.42
19.	0.0	0.0	69.	0.0	0.0	119.	98.00	92.70	169.	62.00	34.00
20.	0.0	0.0	70.	0.0	0.0	120.	98.00	98.87	170.	60.49	30.00
21.	7.33	MOTOPING	71.	0.0	0.0	121.	98.00	100.00	171.	60.00	30.00
22.	23.07	MOTOPING	72.	0.0	0.0	122.	98.00	100.00	172.	58.14	70.00
23.	18.29	MOTOPING	73.	0.0	0.0	123.	98.00	100.00	173.	61.38	72.29
24.	6.67	MOTOPING	74.	0.0	0.0	124.	99.03	100.00	174.	52.08	83.87
25.	9.61	MOTOPING	75.	0.0	0.0	125.	101.15	100.00	175.	45.24	90.00
26.	0.0	0.92	76.	0.0	0.0	126.	108.65	50.09	176.	59.40	90.00
27.	0.0	7.50	77.	34.00	62.39	127.	106.04	40.00	177.	56.56	90.00
28.	0.0	0.0	78.	35.66	77.23	128.	106.88	45.87	178.	53.90	90.16
29.	0.0	0.0	79.	40.00	61.31	129.	113.22	76.96	179.	48.35	100.00
30.	0.0	0.0	80.	40.00	67.75	130.	107.69	33.08	180.	51.99	96.69
31.	0.0	0.0	81.	47.49	87.49	131.	100.48	MOTORING	181.	56.98	90.00
32.	0.0	0.0	82.	48.19	90.00	132.	92.69	MOTORING	182.	58.00	90.00
33.	0.0	0.0	83.	52.13	90.00	133.	88.13	19.01	183.	58.00	90.00
34.	0.0	0.0	84.	54.00	90.00	134.	90.00	9.18	184.	59.92	80.39
35.	0.0	0.0	85.	52.49	90.00	135.	90.50	MOTORING	185.	62.00	38.82
36.	0.0	0.0	86.	67.15	90.00	136.	89.57	MOTORING	186.	62.00	41.02
37.	0.0	0.0	87.	82.00	96.93	137.	82.62	0.0	187.	62.00	70.00
38.	0.0	0.0	88.	83.70	91.49	138.	81.44	0.0	188.	62.00	52.29
39.	0.0	0.0	89.	84.00	90.00	139.	80.24	8.78	189.	64.99	62.43
40.	0.0	0.0	90.	84.33	90.00	140.	80.14	20.71	190.	67.81	60.95
41.	0.0	0.0	91.	86.00	90.00	141.	84.00	40.00	191.	69.75	51.25
42.	0.0	0.0	92.	86.96	90.00	142.	84.70	50.51	192.	66.44	70.00
43.	0.0	0.0	93.	88.00	96.38	143.	83.97	75.08	193.	67.25	70.00
44.	0.0	0.0	94.	88.00	100.00	144.	83.33	40.10	194.	72.42	27.23
45.	0.0	0.0	95.	88.00	90.47	145.	84.00	20.00	195.	78.00	-999.99
46.	0.0	2.40	96.	88.22	90.00	146.	78.12	39.60	196.	74.60	-999.99
47.	0.0	6.02	97.	90.53	90.00	147.	77.73	37.26	197.	71.97	-999.99
48.	0.0	0.0	98.	92.85	94.25	148.	77.18	25.89	198.	68.33	6.43
49.	0.0	0.0	99.	94.00	94.18	149.	79.10	44.52	199.	70.00	90.00

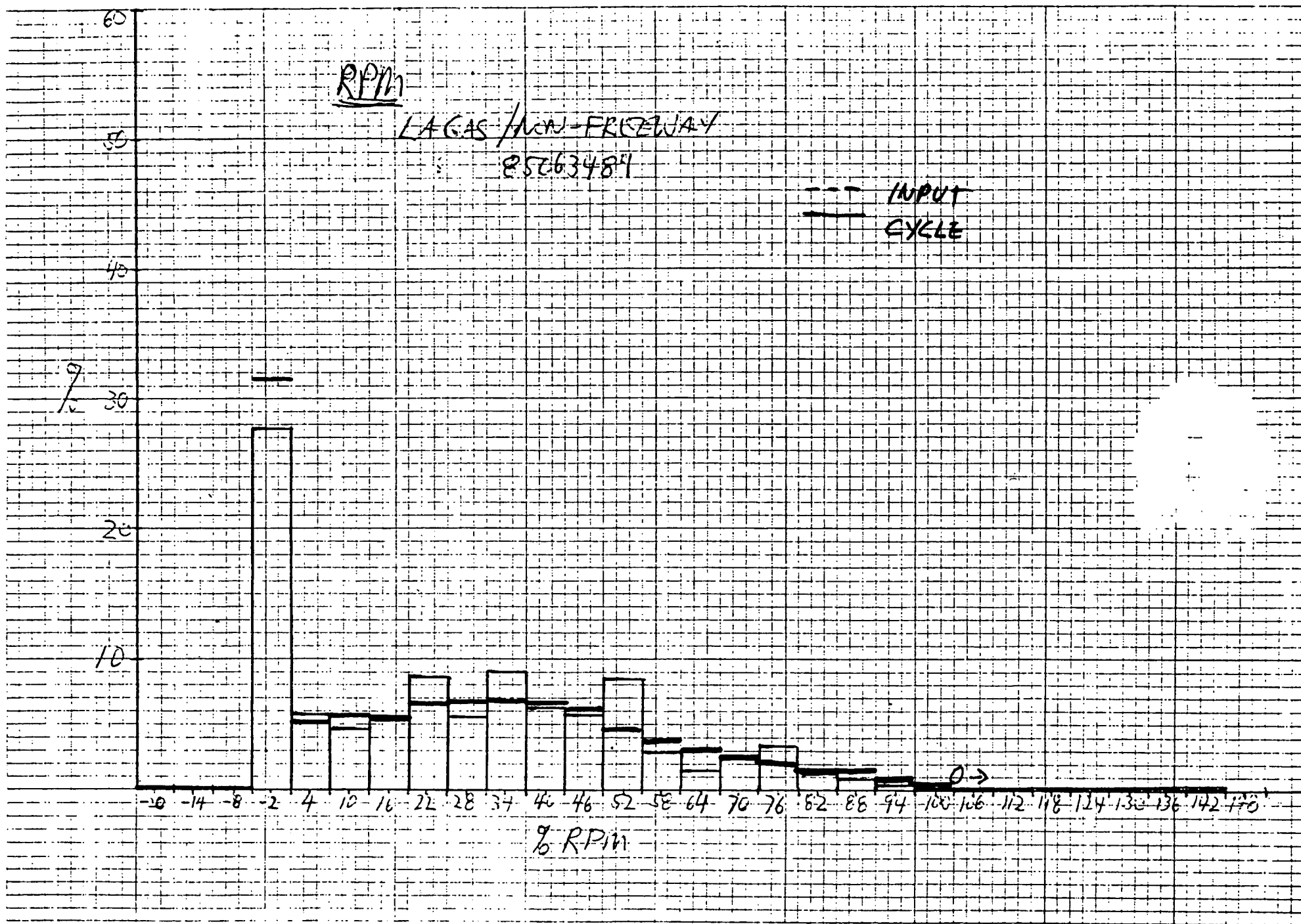
CYCLE #104 094 574

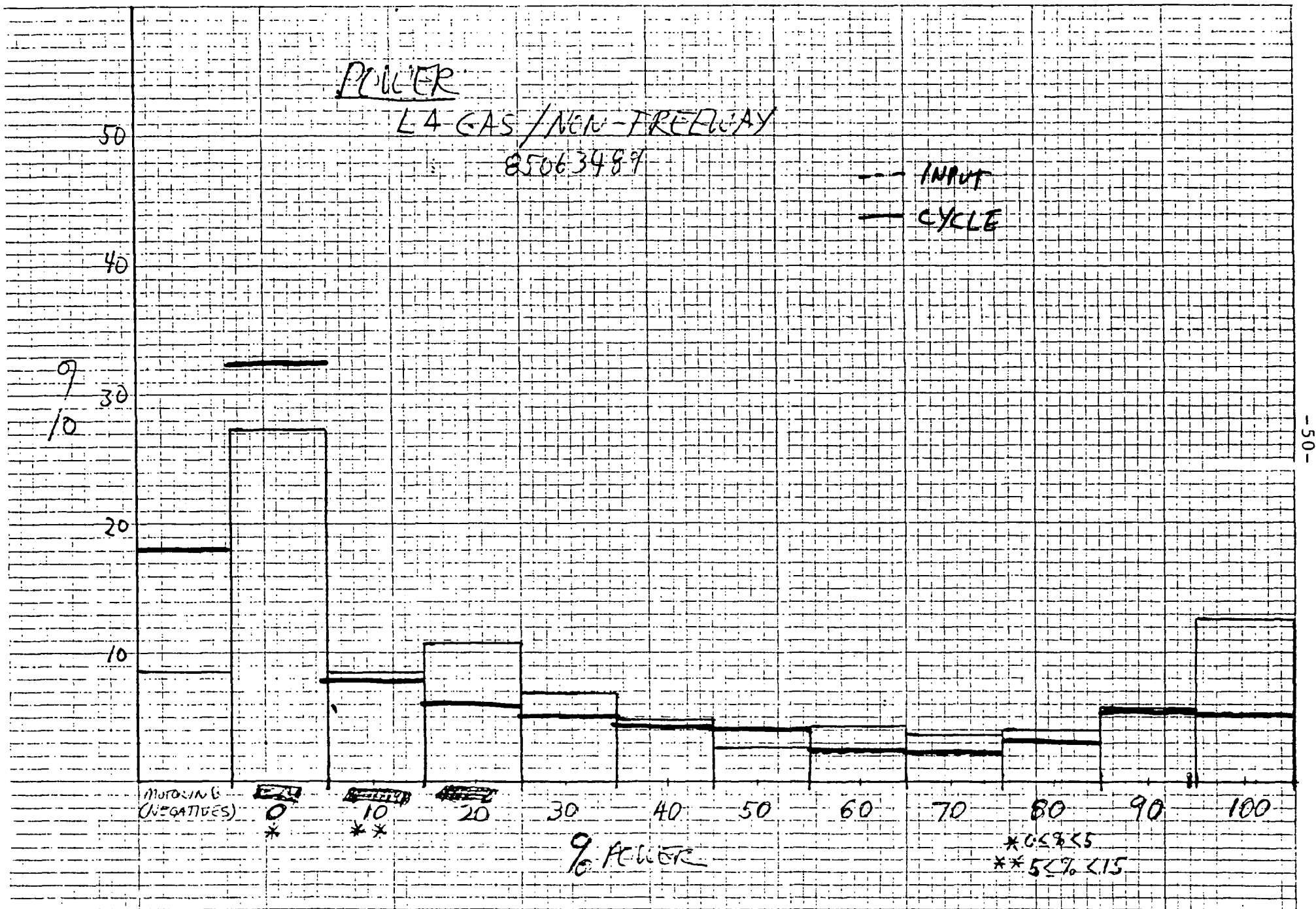
(Page 2)

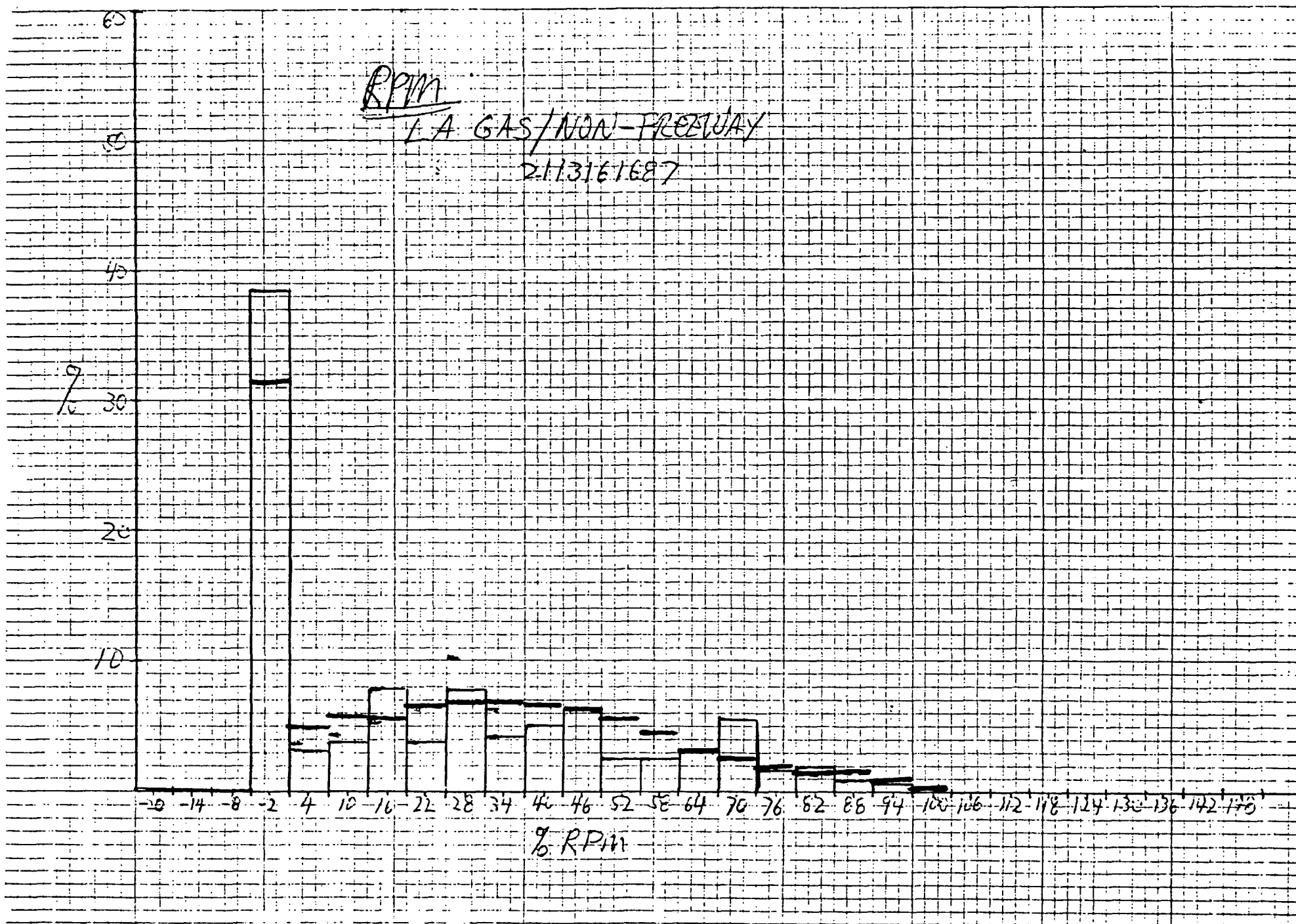
200.	70.96	90.00	250.	82.00	80.00
201.	73.27	70.91	251.	81.00	34.89
202.	75.59	60.00	252.	81.32	MOTORING
203.	91.71	MOTORING	253.	85.26	MOTORING
204.	77.13	MOTORING	254.	82.11	MOTORING
205.	70.00	0.64	255.	83.48	MOTORING
206.	72.54	25.77	256.	80.57	MOTORING
207.	76.00	14.19	257.	82.00	MOTORING
208.	83.33	17.38	258.	79.59	MOTORING
209.	87.79	20.00	259.	78.00	MOTORING
210.	90.00	20.53	260.	81.67	MOTORING
211.	90.00	27.90	261.	80.15	MOTORING
212.	90.00	27.36	262.	82.46	27.69
213.	90.00	40.00	263.	83.22	20.00
214.	92.73	67.30	264.	82.00	14.55
215.	95.68	80.00	265.	72.17	10.00
216.	96.00	80.00	266.	74.88	10.00
217.	94.31	90.00	267.	63.87	10.00
218.	96.00	61.27	268.	54.61	8.26
219.	94.12	24.70	269.	48.66	MOTORING
220.	93.25	48.81	270.	46.09	MOTORING
221.	90.85	67.84	271.	31.67	MOTORING
222.	93.77	70.00	272.	13.15	MOTORING
223.	98.59	70.99	273.	21.52	MOTORING
224.	103.00	64.63	274.	26.00	MOTORING
225.	104.83	20.00	275.	26.00	4.51
226.	106.00	14.29	276.	24.27	MOTORING
227.	104.54	10.00	277.	19.64	MOTORING
228.	99.69	MOTORING	278.	19.49	MOTORING
229.	99.93	MOTORING	279.	23.61	MOTORING
230.	90.91	MOTORING	280.	24.78	MOTORING
231.	67.15	MOTORING	281.	4.69	MOTORING
232.	62.00	MOTORING	282.	0.0	MOTORING
233.	62.00	MOTORING	283.	0.0	0.0
234.	59.69	MOTORING	284.	0.0	0.0
235.	101.37	MOTORING	285.	0.0	0.0
236.	99.71	MOTORING	286.	0.0	0.0
237.	91.40	MOTORING	287.	0.0	0.0
238.	75.00	MOTORING	288.	0.0	0.0
239.	72.77	MOTORING	289.	0.0	0.0
240.	70.46	20.87	290.	0.0	0.0
241.	70.00	39.29	291.	0.0	0.0
242.	69.93	42.59	292.	0.0	0.0
243.	69.00	70.00	293.	0.0	0.0
244.	70.40	74.01	294.	0.0	0.0
245.	74.00	90.00	295.	0.0	0.0
246.	78.29	80.00	296.	0.0	0.0
247.	76.51	80.00			
248.	80.06	80.00			
249.	82.00	80.00			

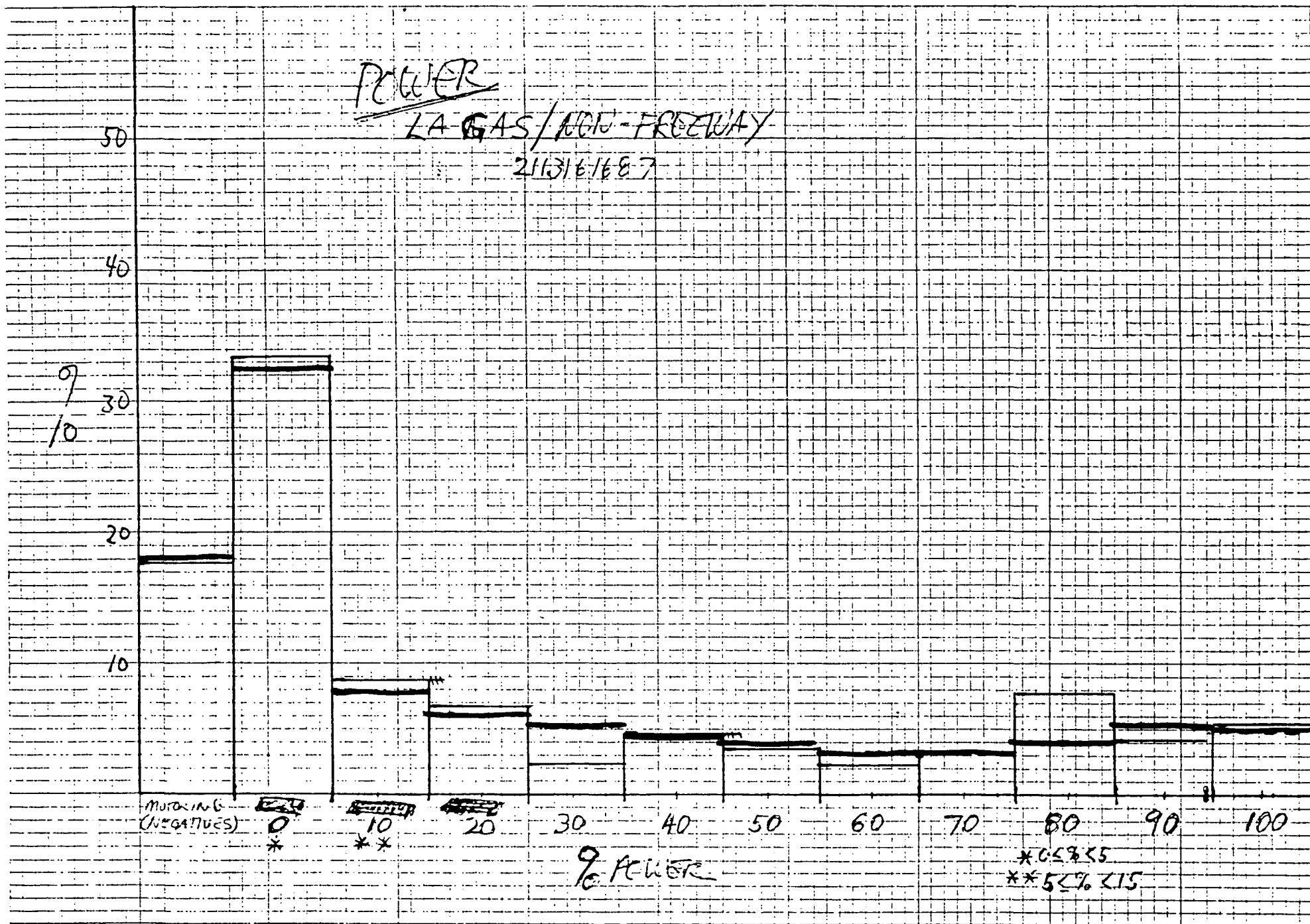
APPENDIX C

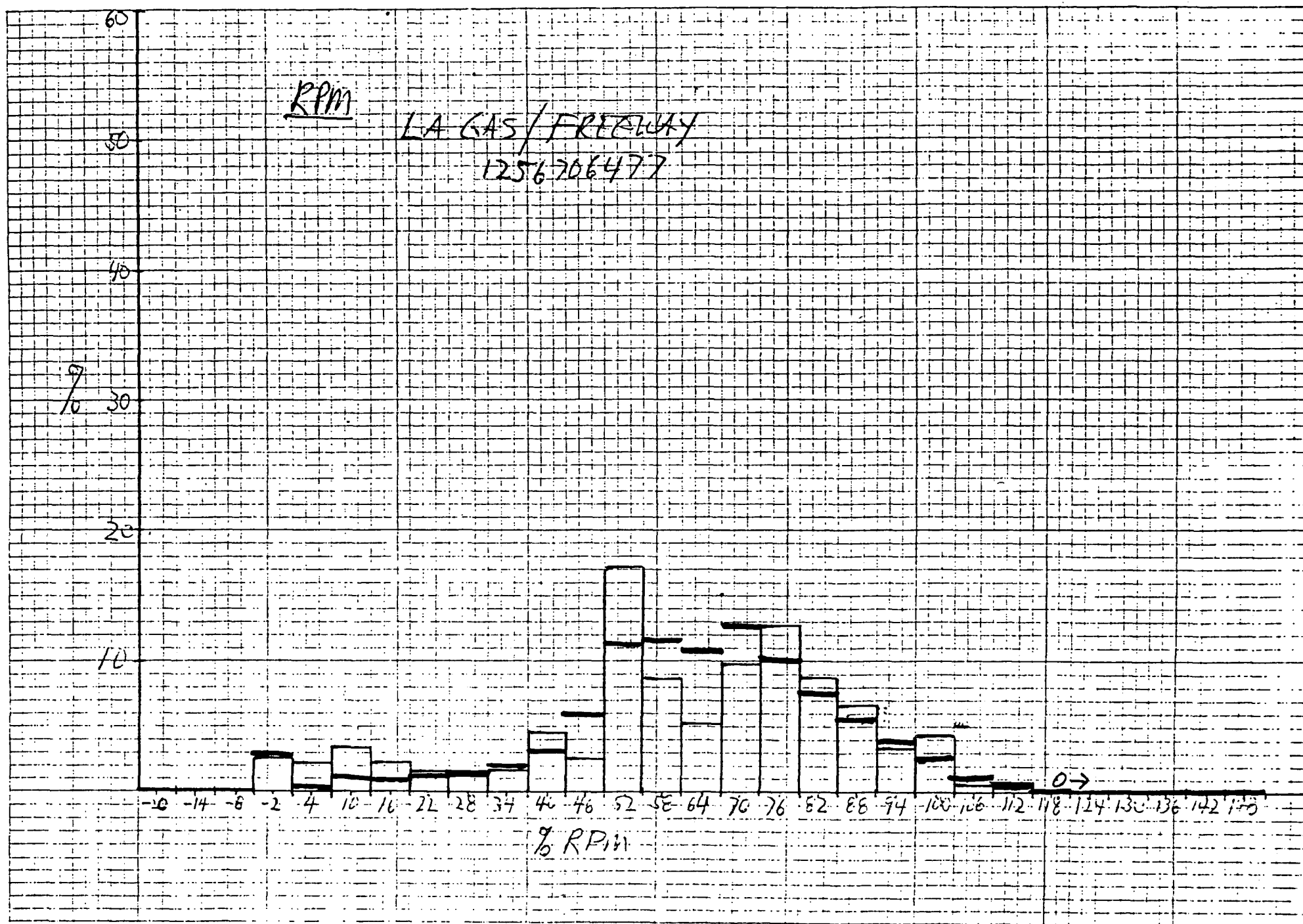
Density Plots
for
Unselected Cycles











POWER

LA GAS/FREWAY

1256706477

9
/0

50

40

30

20

10

MOTORING
(NEGATIVES)

0

*

10

**

20

30

40

50

60

70

80

90

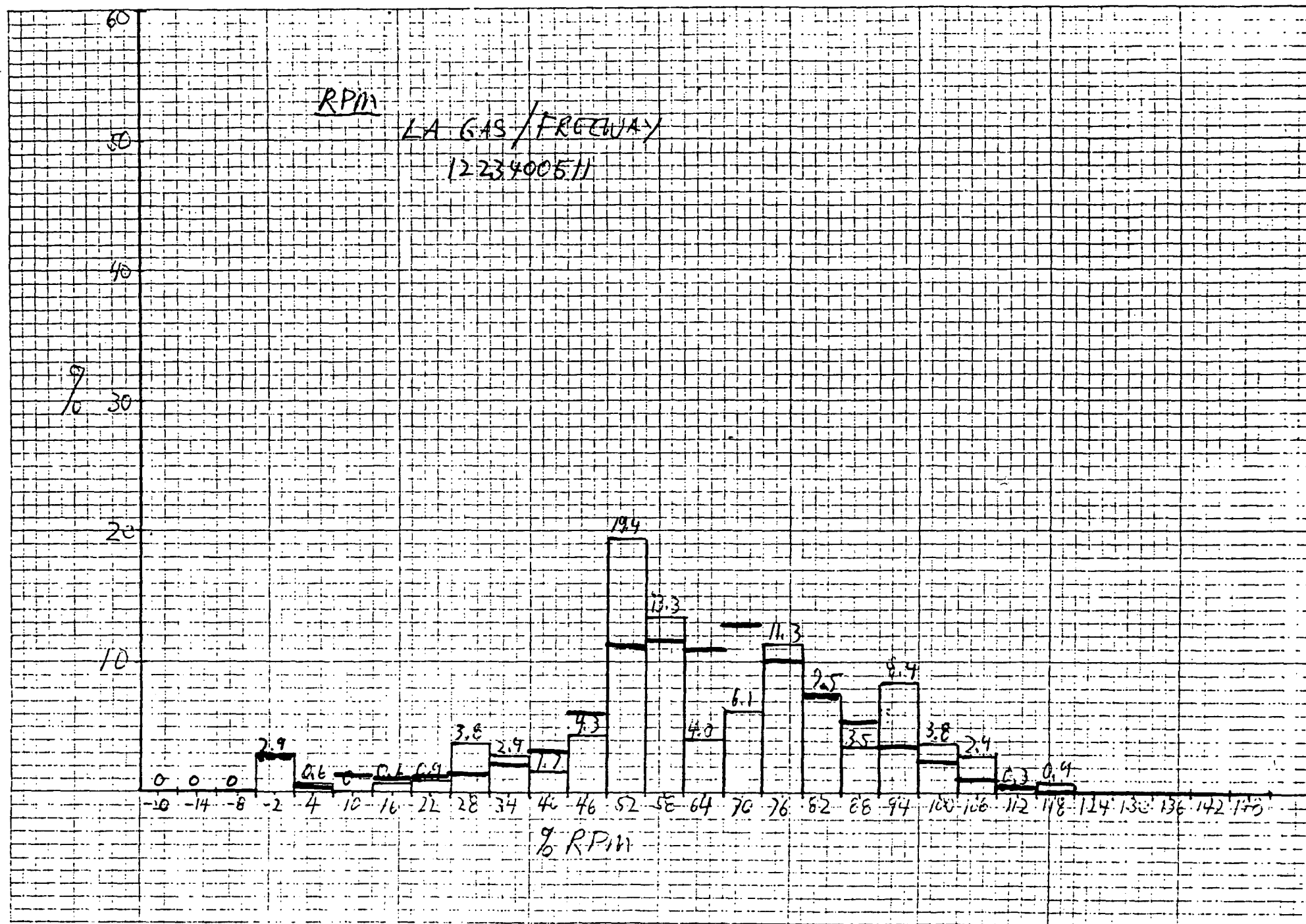
100

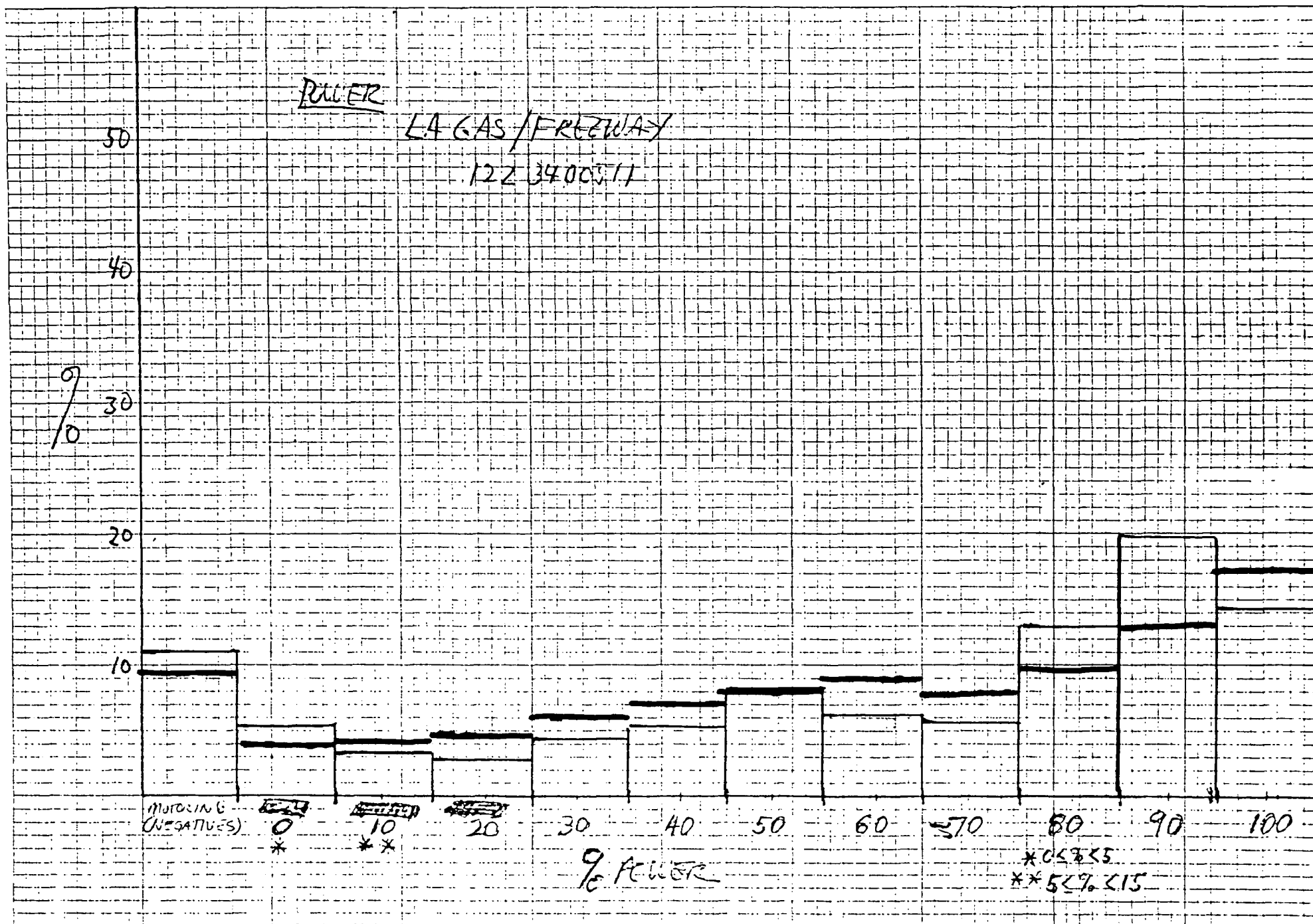
% POWER

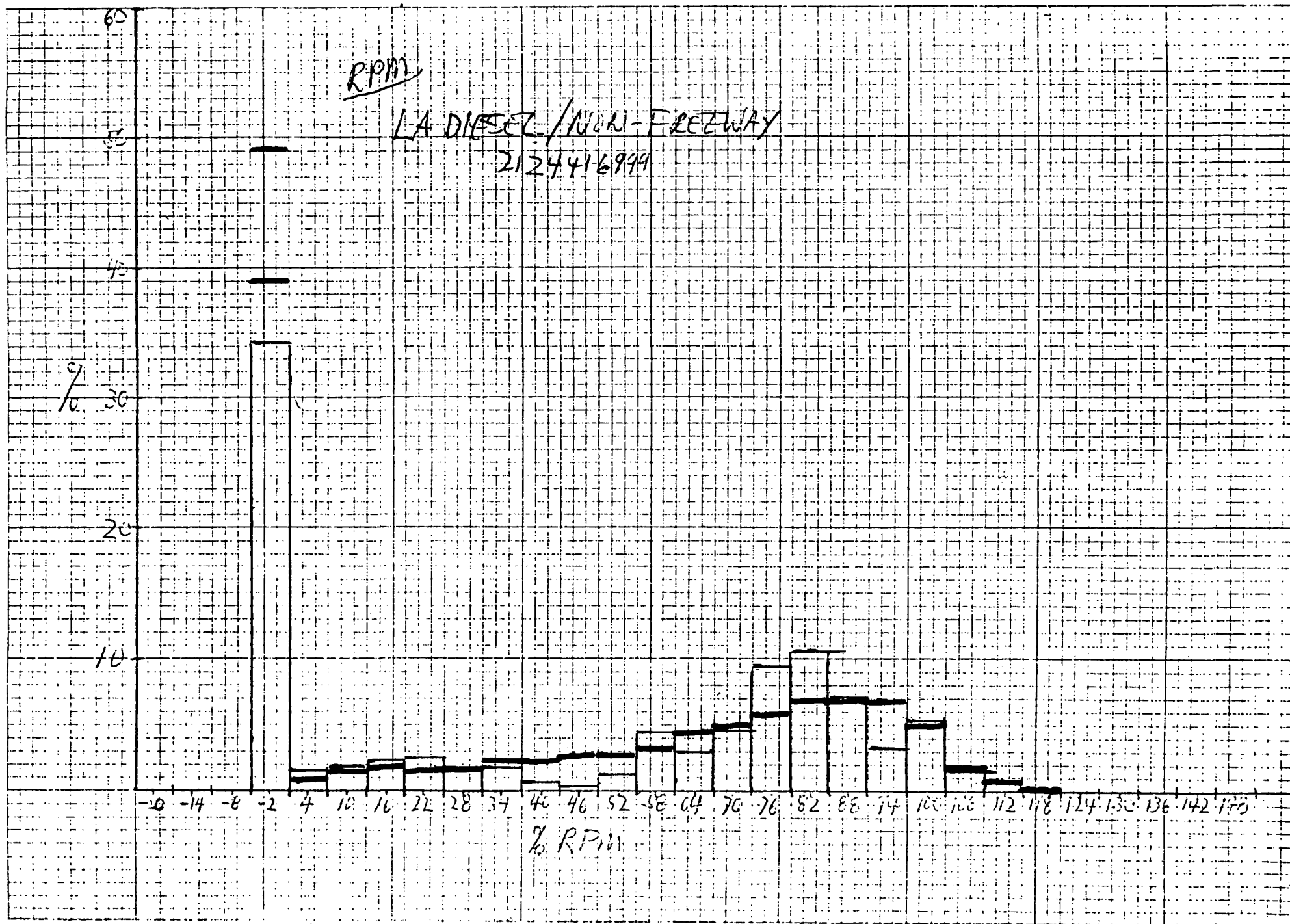
* 0 ≤ 3.5

** 5 ≤ % ≤ 15

54



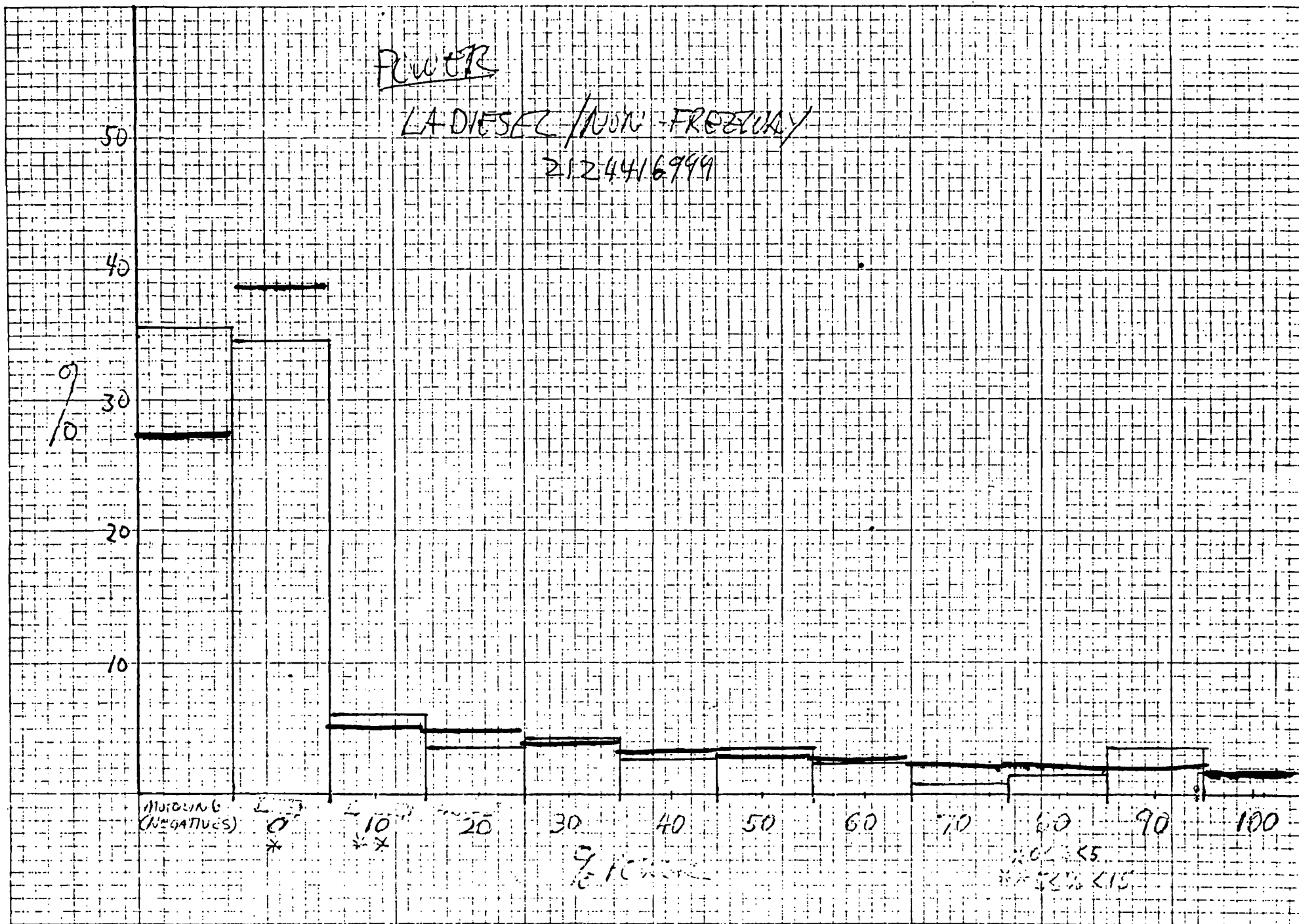


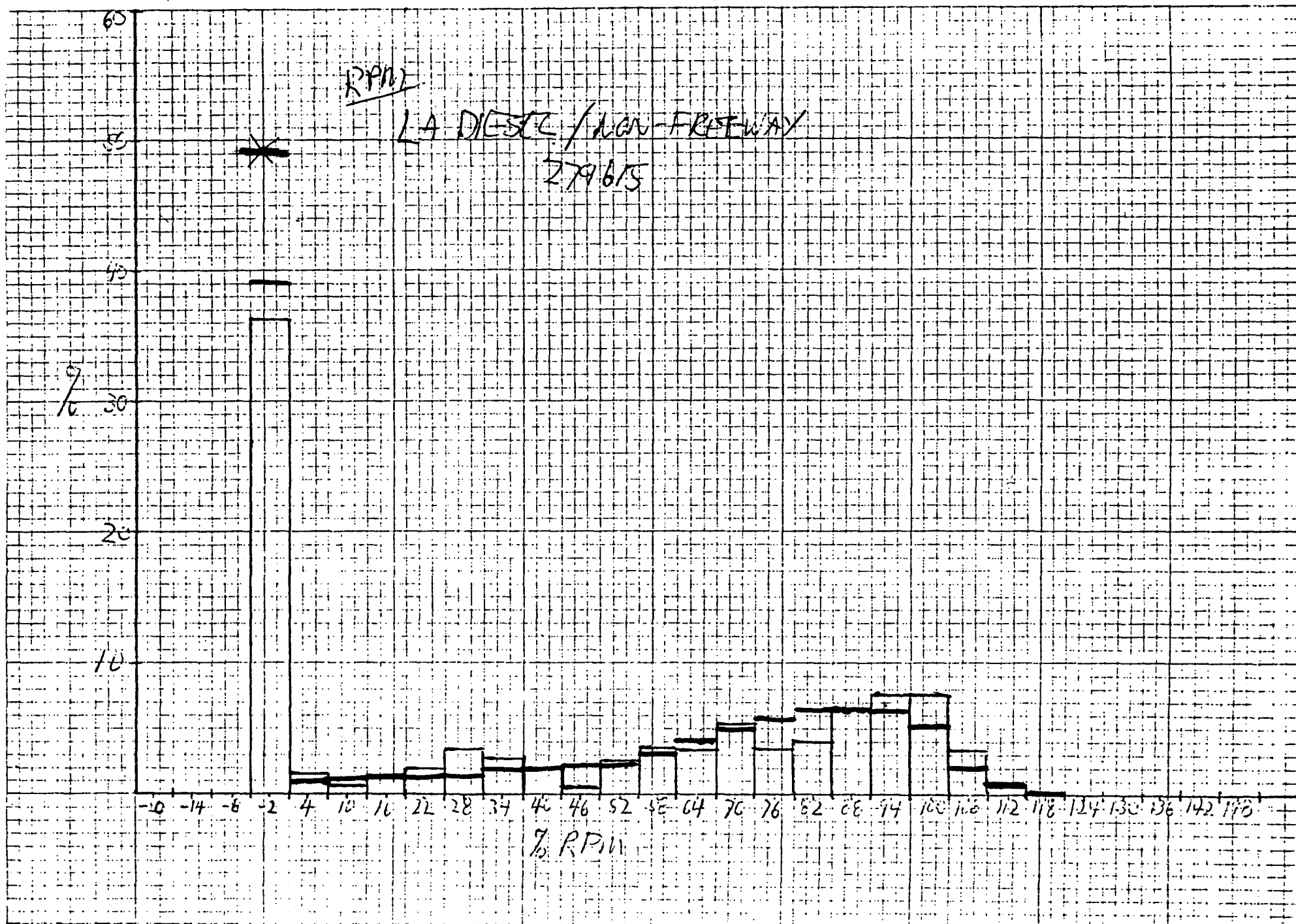


FLUOR

LA DIESEL / NON-FREQUENCY

2124416999





POWER.

LA DIESEL / NON-FREEMAN

27615

9
10

50

40

30

20

10

MORNING
(NEGATIVES)

2-7

10-11

20

30

40

50

60

70

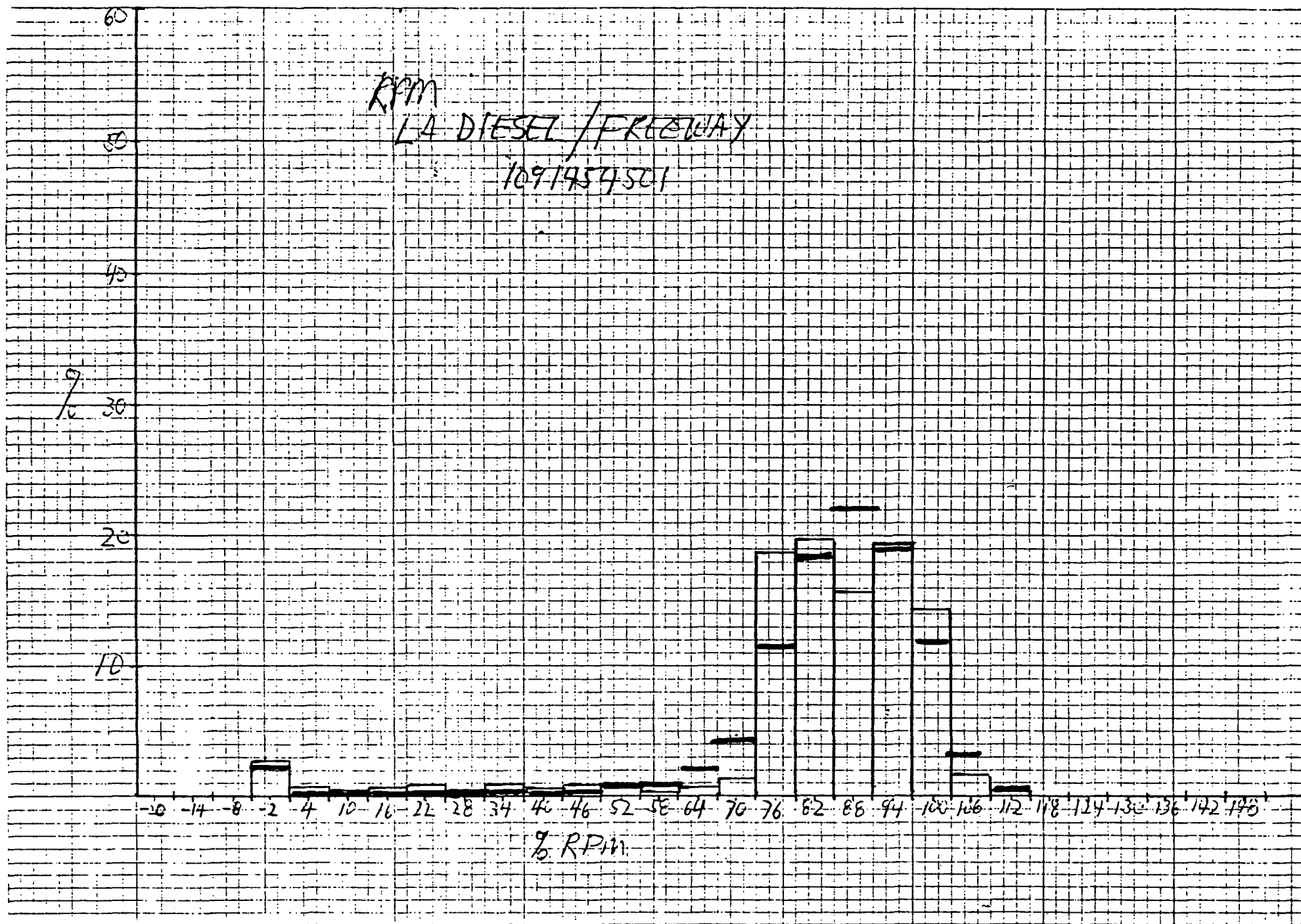
80

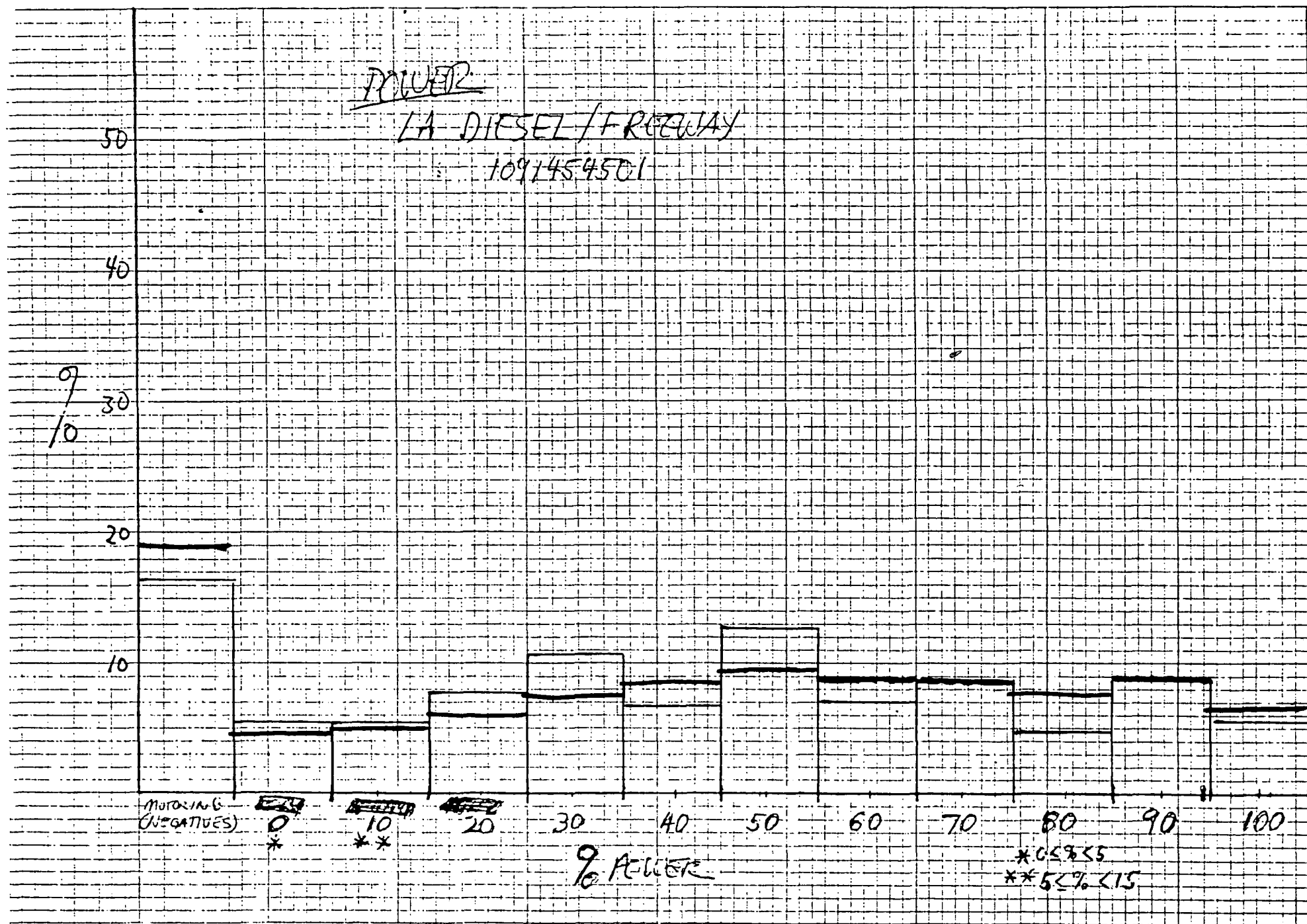
90

100

5-10-15

20-25-30-35-40-45-50-55-60-65-70-75-80-85-90-95-100





RPM

LA DIESEL / FREEWAY

~~1549345415~~

1109958927

$\frac{9}{10}$

-10 -14 -8 -2 4 10 16 22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112 118 124 130 136 142 148

% RPM

POWER

LT DIESEL / FREEWAY

1109958727

9
10

50

40

30

20

10

MOTORING
(NEGATIVES)

0

*

10

**

20

30

40

50

60

70

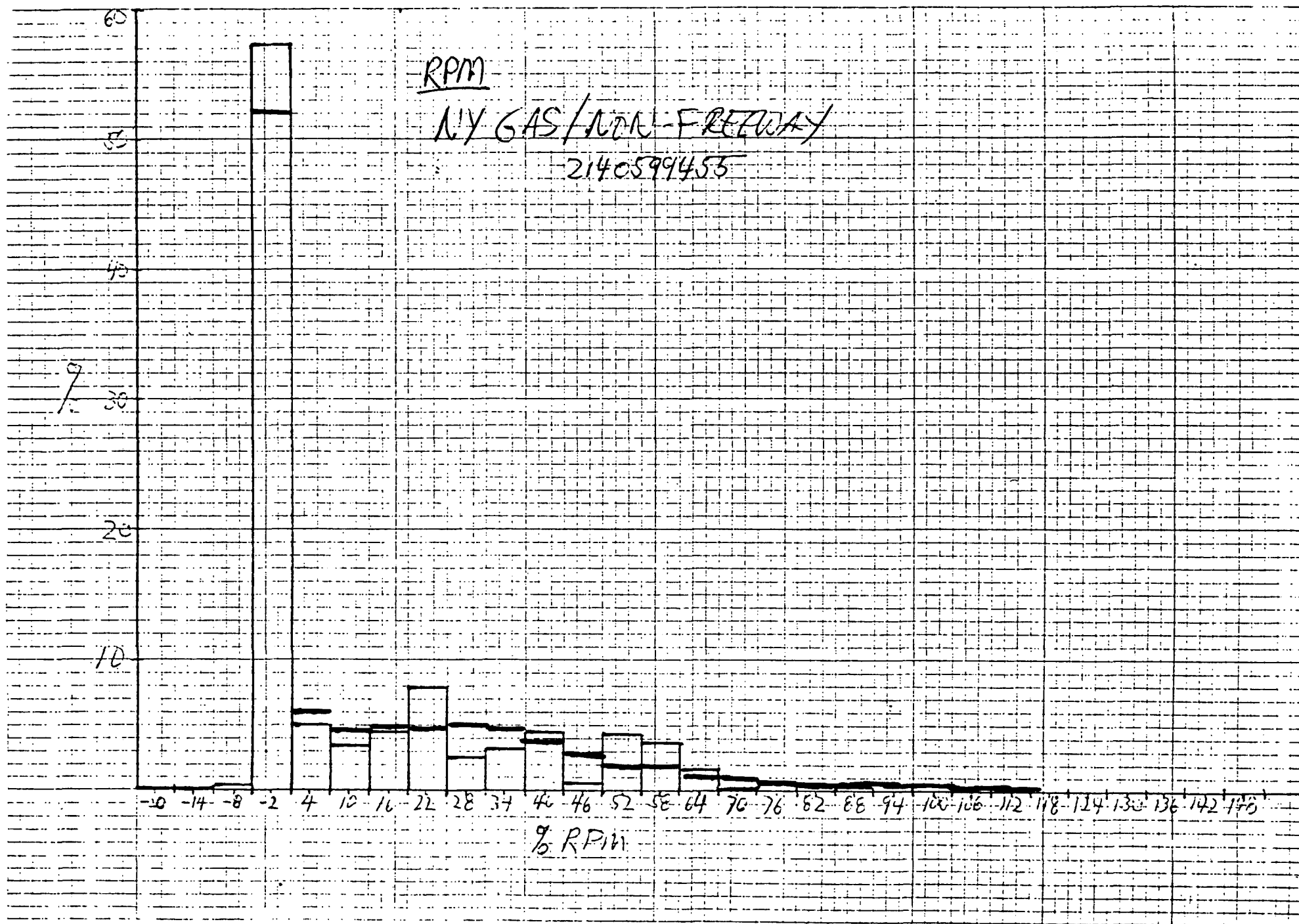
80

90

100

% POWER

* 0.5% < 5
** 5% < 15



POWER

NY GAS / NON-FREWAY

214059.9455

9
/0

50

40

30

20

10

MIRACLES
(NEGATIVES)

~~0~~

*

~~10~~

**

~~20~~

30

40

50

60

70

80

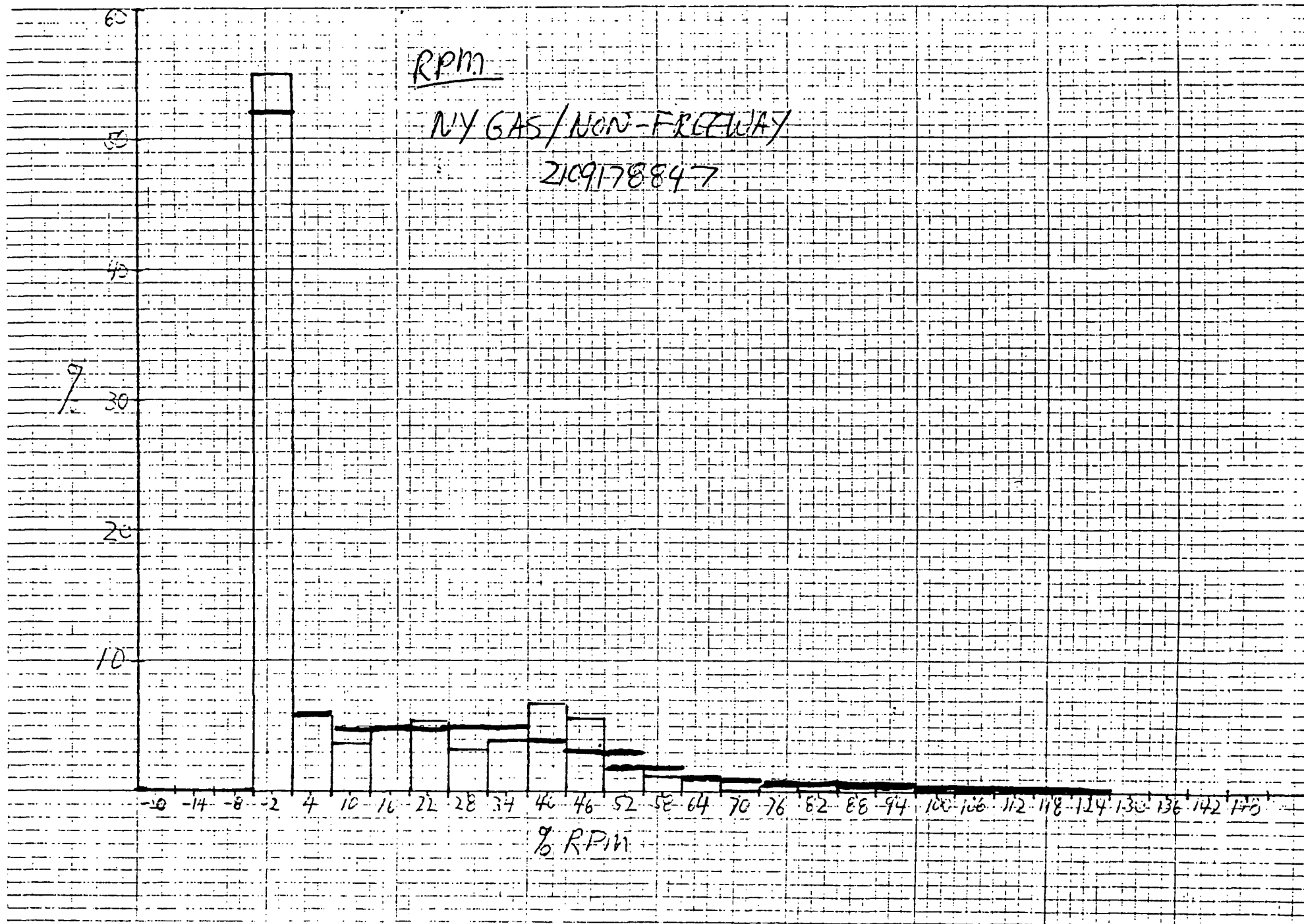
90

100

% POWER

* 0 ≤ % ≤ 5

** 5 ≤ % ≤ 15



POWER

N.Y. GAS/NEW-FREWAY

2109178847

9
10

50

40

30

20

10

MOTORING
(NEGATIVES)

~~0~~

*

~~10~~

**

~~20~~

20

30

40

50

60

70

80

90

100

% FASTER

* 0.5% < 5

** 5% < 15

RPM
NY GAS/FREEMAN

742643
229633293

9
%

10

20

30

40

60

-10 -14 -8 -2 4 10 16 22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112 118 124 130 136 142 148

% RPM

POWER

NY GAS / FREEWAY

229633293

9
10

50

40

30

20

10

MOTORING
(NEGATIVES)

0

10

20

30

40

50

60

70

80

90

100

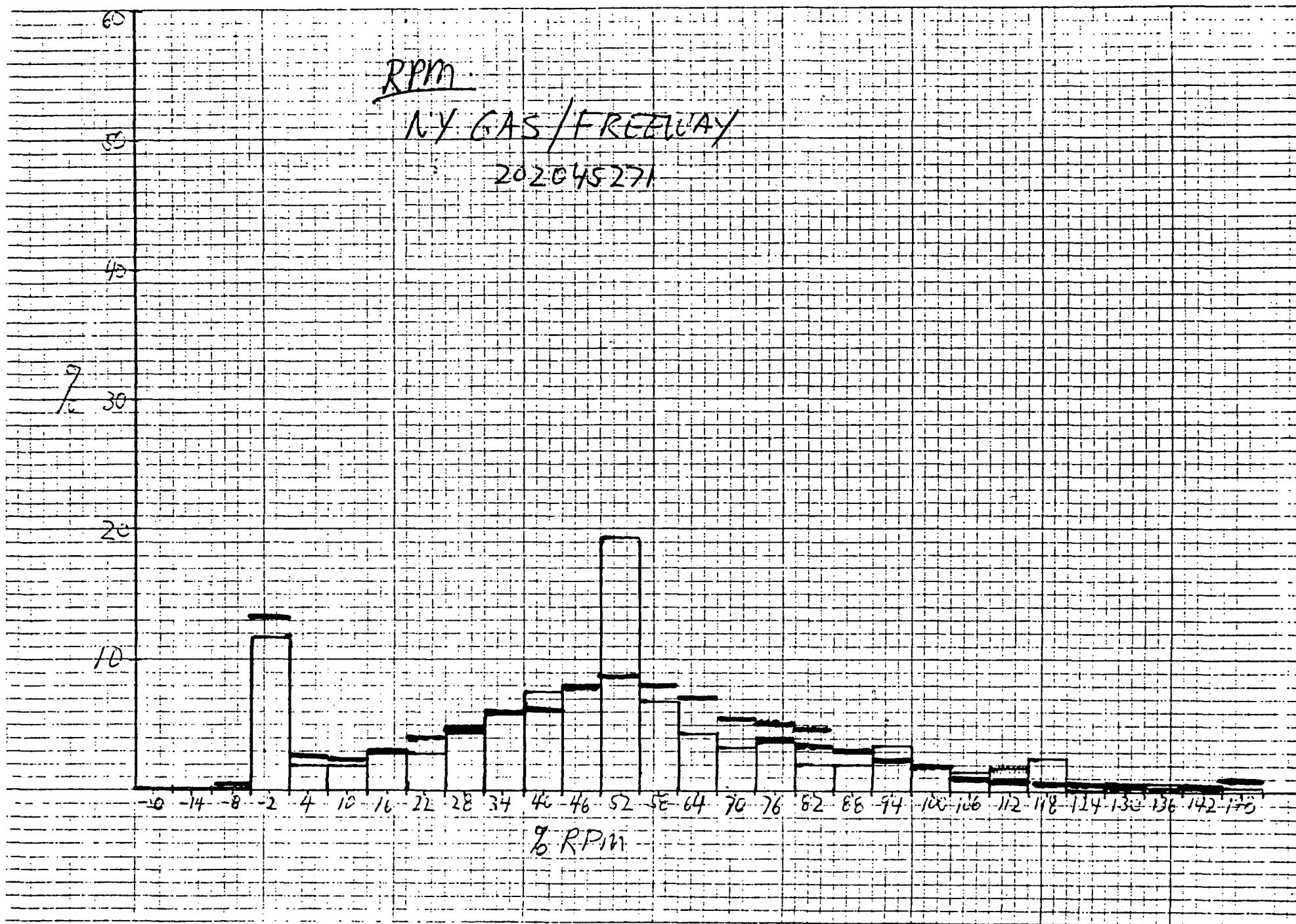
% POWER

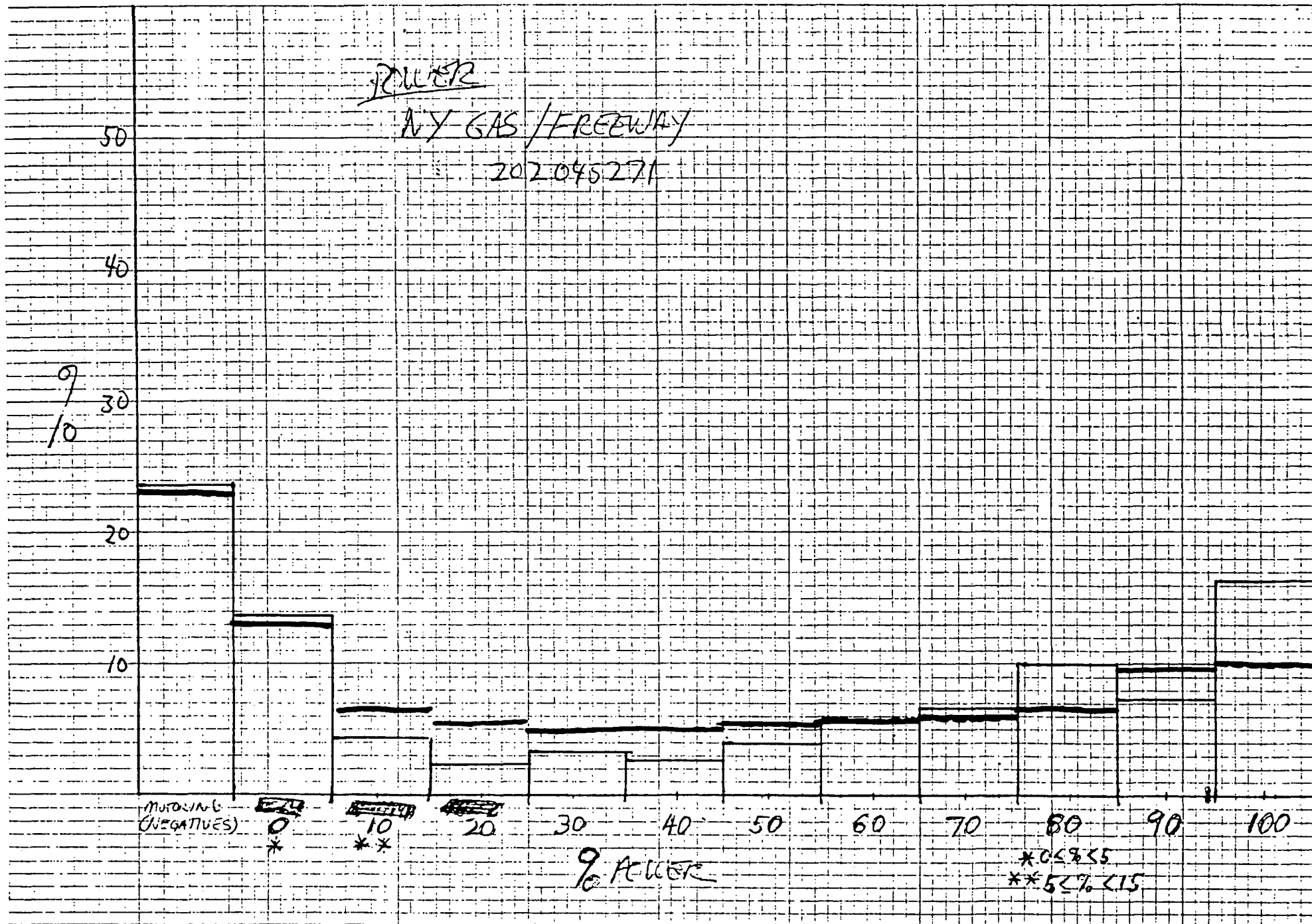
* 0 < 8.5
** 5 < 7 < 15

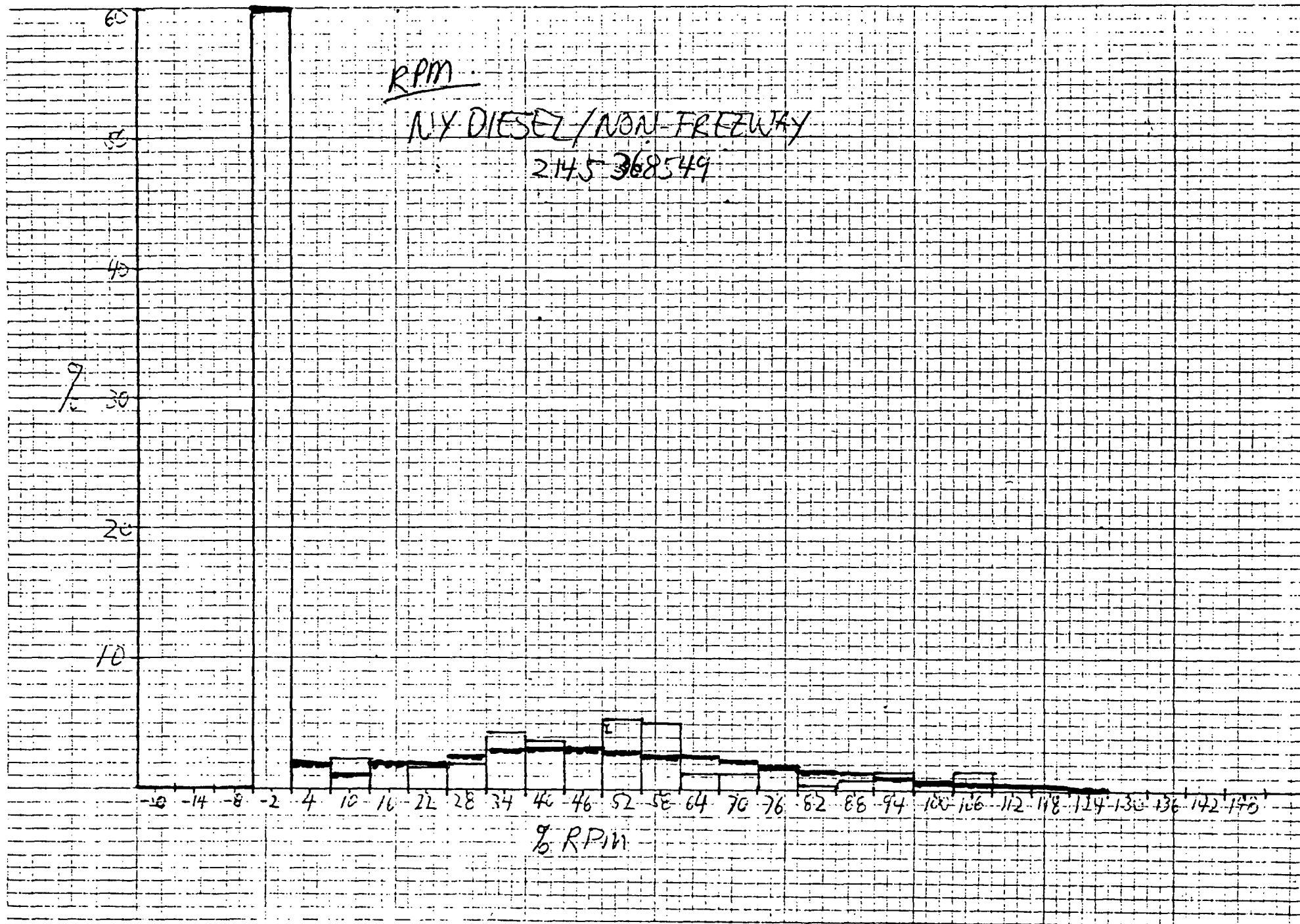
RPM

N.Y. GAS/FREELWAY

202045271

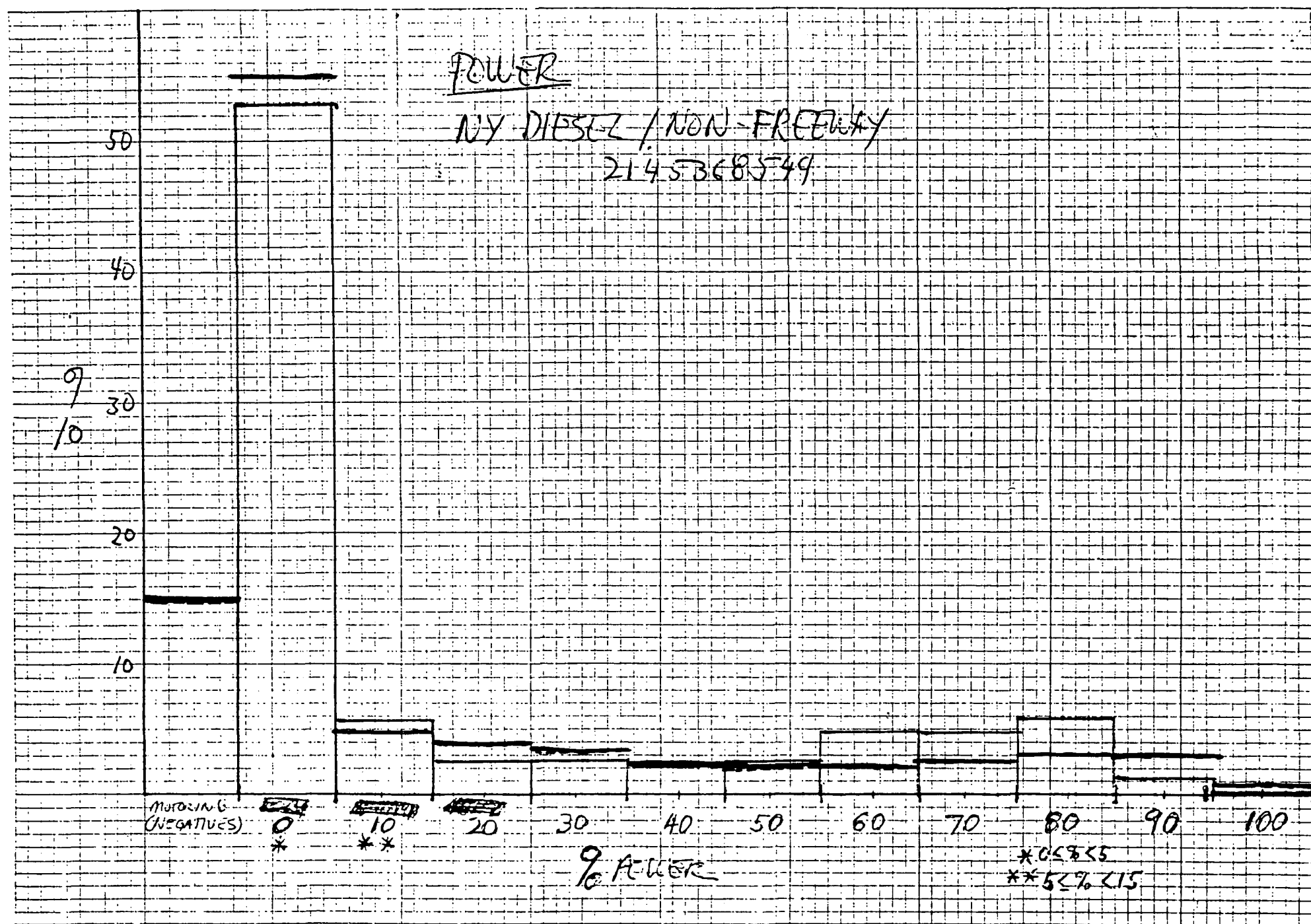






POWER

NY DIESEL / NON-FREEDWAY
2145368549



MOTORING
(NEGATIVES)

0
*

10
**

20

30

40

50

60

70

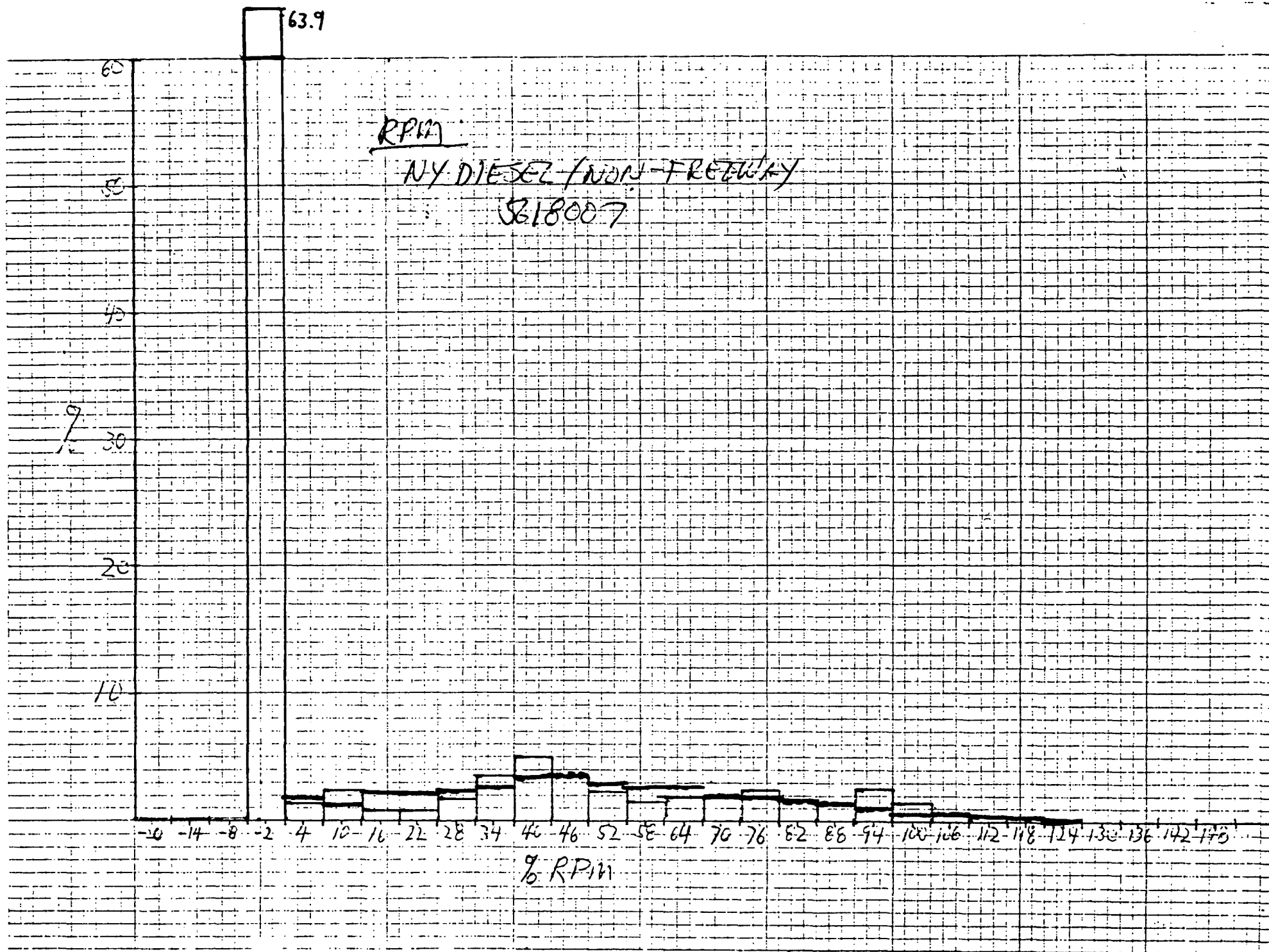
80

90

100

% POWER

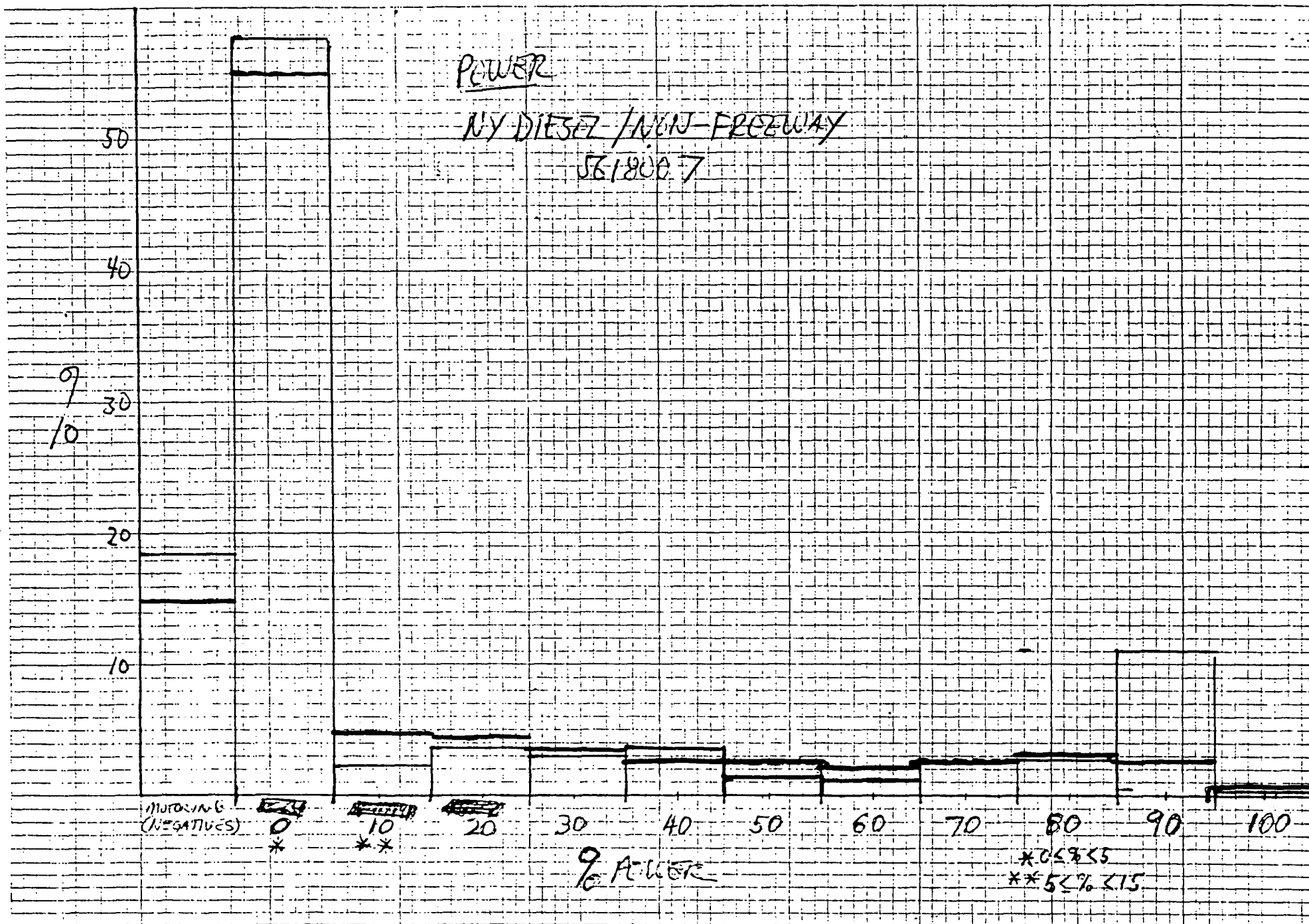
* 0.5% < 5
** 5% < 15



POWER

NY DIESEL / NON-FREWAY

5618007



RPA1

NY DSL/FREWAY

81204277

7

30

20

10

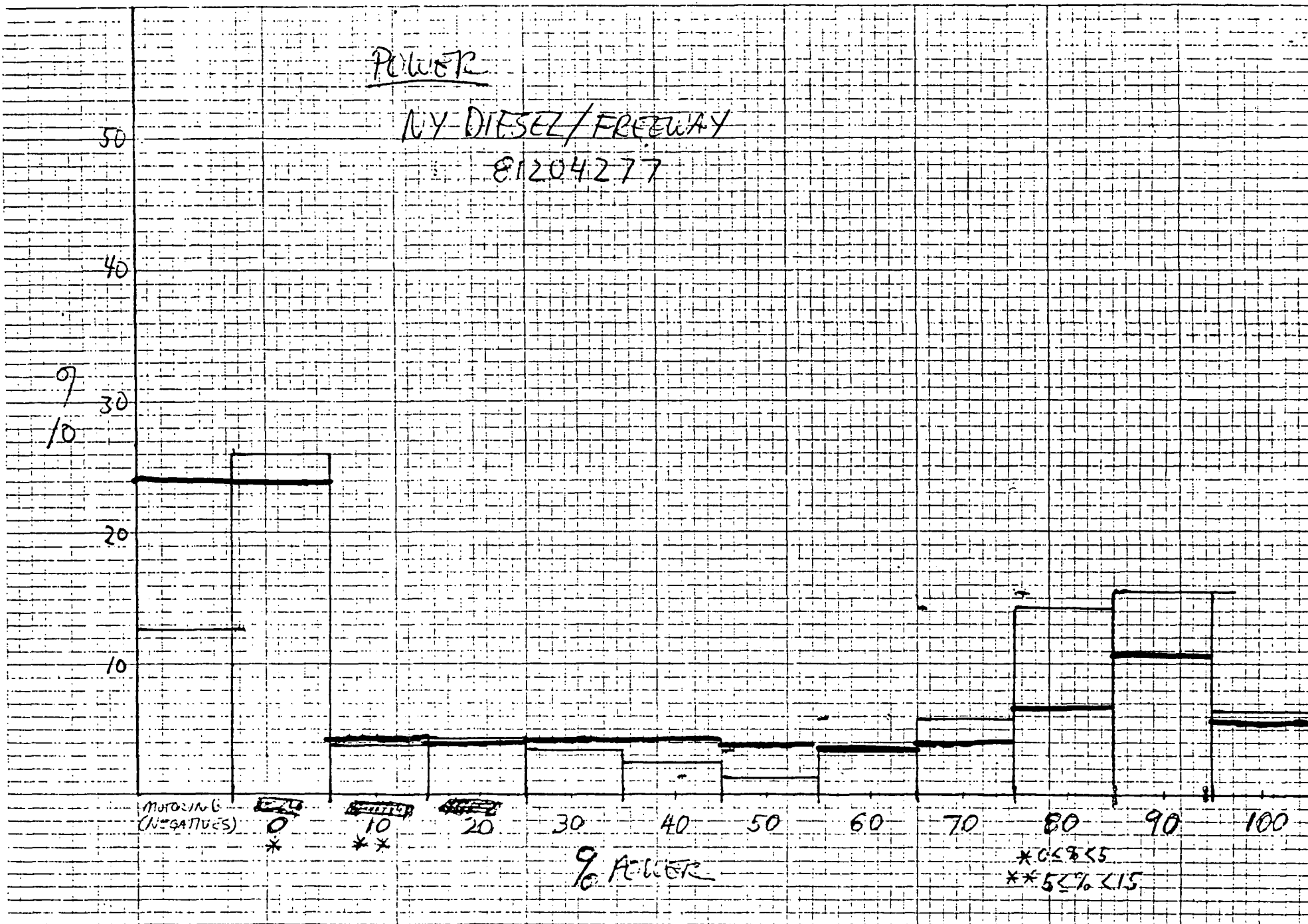
-10 -14 -8 -2 4 10 16 22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112 118 124 130 136 142 148

% RPin

POWER

NY-DIESEL/FREWAY

81204277

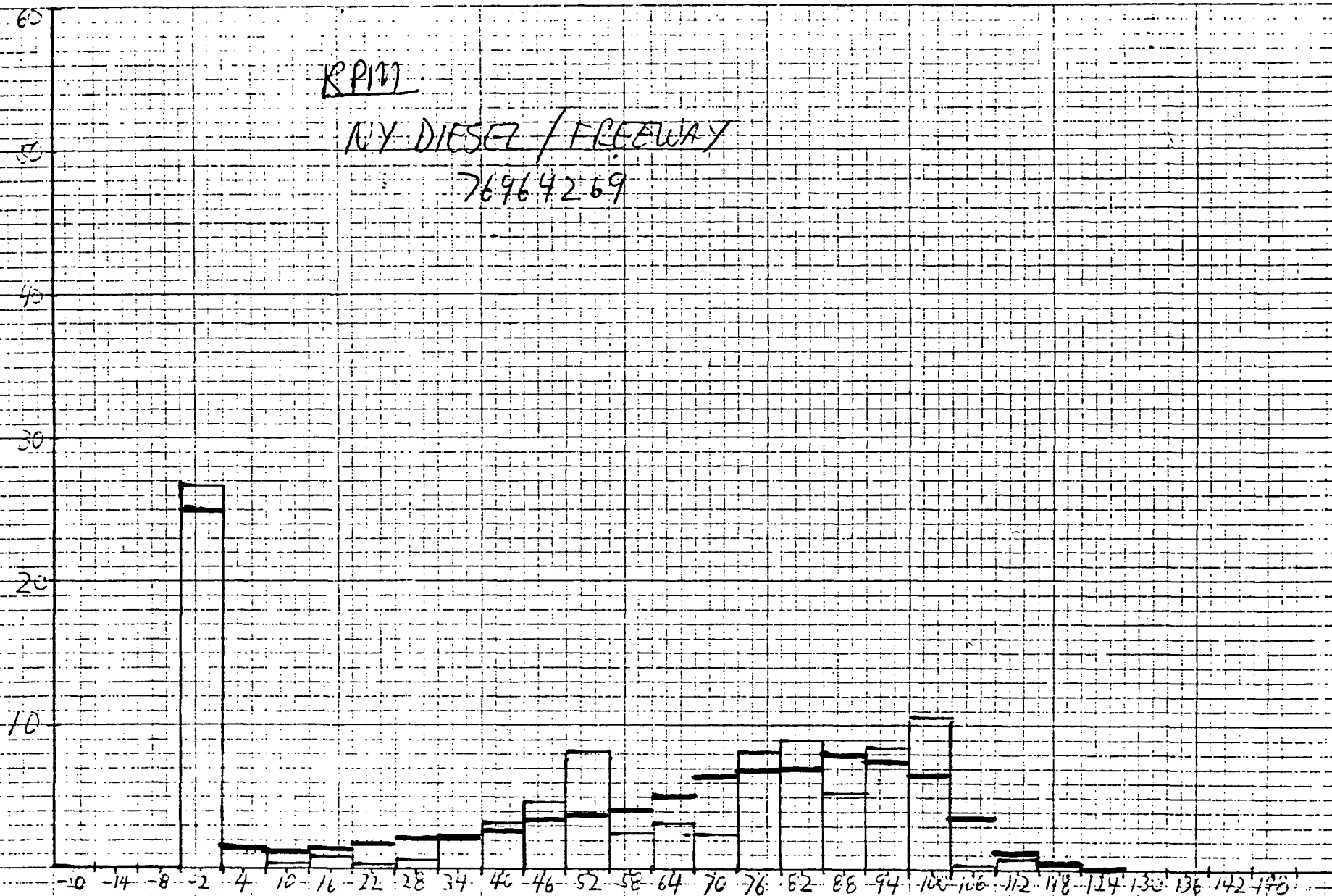


RPM

NY DIESEL / FREEWAY

76964269

7
%



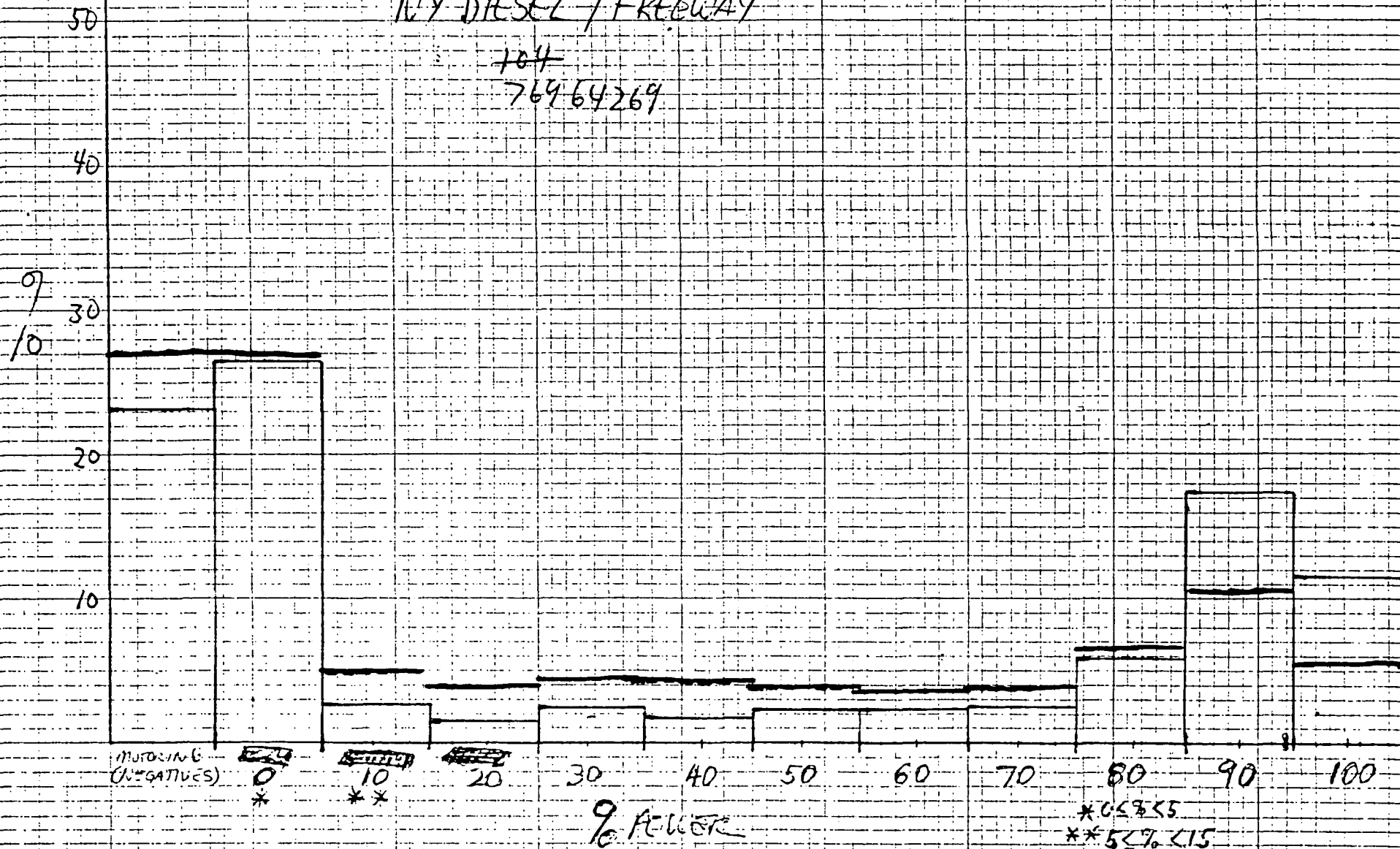
% RPM

POWER

NY DIESEL / FREEWAY

104

76464269



Addendum to
"Selection of Transient Cycles
for Heavy-Duty Engines"

November 1977

The preceeding basic report was originally intended to deal with only the statistical aspects of the transient engine cycles. No attempt was made to assess their physical or practical characteristics nor to justify the selections on the basis of these considerations. Assuming a valid data base, there is no reason to question the "drivability" of any candidate cycles.

Upon subsequent inspection, however, EPA has found that one category, N.Y. Gas Freeway, shows an unrealistic amount of high speed operation at abnormally high speeds (in the chosen cycle, #7920-, this amounted to some 26 seconds of sustained operation above 100% rated RPM, reaching a maximum of 150%). Since the candidate cycles for this category all matched the input to some extent, it appeared that the data base might be flawed. Indeed, when the CAPE-21 data for the New York trucks were reviewed, one truck was identified as having an inordinate amount of operation above 100% rated RPM, nearly 40% of its total operation. This single truck (number 09) also comprised a substantial portion (12.3%) of the NY gasoline freeway data. Something more than 83% of the total operation above 100% rated RPM in this category was contributed by this truck. Also, this truck accounted for nearly 100% of the operation above 116% rated RPM.

The offending truck appears to have exhibited the excessive speeds because of an error in the RPM normalization process. The absolute RPM values originally recorded may have easily been reasonable; but the large number of normalized values (see footnote p. 7 of the report) in excess of 100% indicate that the rated RPM was misidentified for this particular truck. In any case, the RPM data for the truck is tainted and its presence in the input can be expected to have had some undesirable effects.

As a remedy to the situation, EPA has decided to delete from cycle 7920-the portion which exceeds a percent RPM value of 100, i.e., the cycle will merely be shortened by the 26 seconds of "overspeed" operation (see attachment). The effects which this action will necessarily have on the cycle are addressed below.

Expressed concisely, the presence of data from truck 09 compromises the representativeness of any cycle generated from the NY Gas Freeway data base. On the other hand, it cannot be assumed that the correlation to the road data has been lost. What is known is that in the higher speed range (over 116% RPM), all of the operation is due to Truck 09, and nothing is compromised by taking this operation out. Also along these lines, the corresponding power values in the deleted segment were derived as well from the Truck 09 data (by virtue of the cycle generation procedure).

However, Truck 09 also understandably exhibited operation in the sub-100% RPM range, and the percent RPM values here too will be unreasonably high. This effect is of somewhat less magnitude than that in the high ranges (where Truck 09 is 100% of the data), but to what extent the 8% of the data which Truck 09 represents in the lower ranges affects

this cycle is unclear. Also, because of the removal of power as well as RPM values from the cycle, the power density function will be somewhat altered (although this change is not radical).

Finally, EPA has done no statistical testing of the quality of the modified cycle; actually, such a check is meaningless because the input with which the cycle would be compared is itself no longer valid. The matrix from which the cycles were generated will change if Truck 09 is deleted, but the complexity of the matrix would make any determination of how it is altered an enormous task of questionable value.

The revised cycle does compromise the representativeness of this category's road data; despite this, it is felt that at the very least the cycle is certainly more representative than the original version. The range of speed is more reasonable, and when its limitations are recognized, the cycle is an adequate substitute.

Truck 09 also had some non-freeway operation comprising 6.9% of the total NY Gas Non-Freeway data. Hence, the quality of the cycle chosen for this category, #841-, is diminished somewhat. It is felt, however, that the contribution of truck 09 to the non-freeway data is not sufficient to require modification or replacement of cycle 841-, and it remains as it appears in the main report.

CYCLE #792043535
New York - All Gasline
FREEWAY

SECOND	% RPM	% POWER	SECOND	% RPM	% POWER	SECOND	% RPM	% POWER	SECOND	% RPM	% POWER
0.	0.0	0.0	50.	50.00	60.00	100.	66.52	87.40	150.	150.00	30.00
1.	0.0	0.0	51.	50.00	60.00	101.	66.00	98.97	151.	130.07	-999.99
2.	0.0	0.0	52.	50.00	60.00	102.	67.89	100.00	152.	120.30	-999.99
3.	0.0	0.0	53.	50.00	49.74	103.	66.00	100.00	153.	120.00	-999.99
4.	0.0	0.0	54.	50.00	30.00	104.	66.00	100.00	154.	121.91	80.00
5.	0.0	0.0	55.	51.00	21.43	105.	66.00	100.00	155.	130.38	80.00
6.	0.0	0.0	56.	50.00	20.00	106.	66.00	100.00	156.	135.11	85.54
7.	0.0	0.0	57.	50.00	0.57	107.	67.63	91.59	157.	138.84	90.00
8.	0.0	0.0	58.	50.00	MOTORING	108.	68.00	90.00	158.	140.00	90.00
9.	0.0	0.0	59.	50.00	62.86	109.	70.00	80.00	159.	139.95	87.67
10.	0.0	0.0	60.	50.00	65.56	110.	70.00	76.85	160.	137.27	-999.99
11.	0.0	0.0	61.	50.00	47.99	111.	70.00	70.00	161.	131.96	-999.99
12.	0.0	0.0	62.	53.03	40.00	112.	70.00	70.00	162.	128.00	-999.99
13.	0.0	0.0	63.	54.00	21.61	113.	70.00	77.85	163.	126.89	-999.99
14.	0.0	0.0	64.	54.15	21.47	114.	71.89	72.57	164.	124.37	71.29
15.	1.44	0.0	65.	56.00	42.31	115.	72.00	67.99	165.	125.94	99.70
16.	8.15	10.77	66.	56.00	46.12	116.	72.00	57.74	166.	82.00	91.28
17.	14.70	20.00	67.	56.00	50.91	117.	72.00	67.54	167.	82.57	100.00
18.	21.00	20.00	68.	56.00	52.97	118.	70.35	15.64	168.	86.65	100.00
19.	21.98	10.00	69.	56.00	41.40	119.	68.54	MOTORING	169.	90.00	100.00
20.	26.30	4.91	70.	58.00	20.53	120.	68.00	MOTORING	170.	90.00	100.00
21.	29.93	00.00	71.	58.00	50.00	121.	67.91	MOTORING	171.	93.66	100.00
22.	35.55	90.00	72.	58.00	46.57	122.	66.00	MOTORING	172.	94.00	92.08
23.	39.24	90.00	73.	54.00	44.90	123.	65.23	11.53	173.	94.00	-999.99
24.	40.00	82.22	74.	58.00	43.53	124.	64.00	44.83	174.	94.77	-999.99
25.	40.00	80.00	75.	58.00	40.00	125.	64.00	25.51	175.	96.00	-999.99
26.	40.14	80.00	76.	58.00	40.00	126.	64.00	11.53	176.	94.60	-999.99
27.	42.00	80.00	77.	60.24	40.00	127.	64.00	0.11	177.	92.28	-999.99
28.	42.91	80.00	78.	61.45	40.00	128.	62.88	MOTORING	178.	91.57	-999.99
29.	44.00	67.06	79.	60.00	44.34	129.	63.00	45.35	179.	66.00	70.00
30.	44.00	71.66	80.	58.82	14.50	130.	62.85	35.37	180.	64.68	70.00
31.	44.00	90.00	81.	56.50	MOTORING	131.	73.24	30.00	181.	62.93	50.46
32.	44.00	90.00	82.	57.81	MOTORING	132.	74.00	30.00	182.	64.00	23.54
33.	43.61	86.12	83.	58.00	MOTORING	133.	75.87	48.57	183.	64.00	-999.99
34.	42.00	70.00	84.	57.11	MOTORING	134.	73.18	50.91	184.	62.08	-999.99
35.	42.00	50.82	85.	51.00	MOTORING	135.	80.00	42.61	185.	33.05	-999.99
36.	42.00	43.34	86.	52.93	6.08	136.	79.19	2.17	186.	25.45	-999.99
37.	43.65	31.76	87.	52.00	33.87	137.	78.00	31.26	187.	20.54	-999.99
38.	44.00	30.81	88.	53.70	65.53	138.	80.93	25.59	188.	12.46	-999.99
39.	44.00	40.00	89.	56.00	60.00	139.	82.00	23.79	189.	7.01	-999.99
40.	44.59	45.42	90.	56.00	60.00	140.	122.00	39.65	190.	2.38	-999.99
41.	46.00	46.40	91.	58.00	47.08	141.	122.00	39.64	191.	2.00	0.0
42.	46.00	35.11	92.	56.00	20.00	142.	124.00	75.50	192.	2.44	15.39
43.	46.00	47.64	93.	57.28	32.76	143.	124.00	70.00	193.	4.75	70.00
44.	46.00	50.00	94.	58.00	40.00	144.	124.00	70.00	194.	15.62	70.00
45.	48.00	49.17	95.	58.00	40.00	145.	123.93	70.00	195.	24.00	63.08
46.	48.00	35.19	96.	60.22	80.00	146.	145.68	70.00	196.	25.70	60.00
47.	48.00	20.00	97.	63.07	77.33	147.	146.58	63.14	197.	26.00	59.93
48.	49.11	36.65	98.	66.00	70.00	148.	150.00	22.95	198.	26.00	54.93
49.	50.00	57.12	99.	67.16	75.32	149.	150.00	30.00	199.	26.00	70.35

CYCLE #792043 535

(Page 2)

SECOND	% RPM	% POWER	SECONDS	% RPM	% POWER
200.	26.96	50.00	250.	31.62	MOTORING
201.	29.27	50.00	251.	29.00	MOTORING
202.	30.00	50.00	252.	28.68	MOTORING
203.	30.00	40.49	253.	24.74	14.47
204.	34.22	18.91	254.	24.00	10.27
205.	35.47	10.00	255.	24.00	8.70
206.	34.00	5.77	256.	24.00	0.0
207.	36.32	MOTORING	257.	23.11	MOTORING
208.	32.09	4.76	258.	19.59	MOTORING
209.	30.00	1.04	259.	13.45	MOTORING
210.	32.74	90.00	260.	2.84	72.46
211.	45.00	90.00	261.	5.56	77.80
212.	45.26	93.68	262.	0.0	47.69
213.	42.95	100.00	263.	0.78	47.76
214.	41.37	100.00	264.	2.00	21.84
215.	45.68	100.00	265.	2.00	MOTORING
216.	46.00	100.00	266.	2.00	MOTORING
217.	44.00	100.00	267.	0.0	0.0
218.	44.62	96.88	268.	0.0	0.0
219.	54.45	43.05	269.	0.0	0.0
220.	65.25	MOTORING	270.	0.0	0.0
221.	66.00	MOTORING	271.	0.0	0.0
222.	64.12	MOTORING	272.	0.0	0.0
223.	60.00	MOTORING	273.	0.0	0.0
224.	59.49	12.32	274.	0.0	0.0
225.	59.00	MOTORING	275.	0.0	0.0
226.	59.00	MOTORING	276.	0.0	0.0
227.	59.00	MOTORING	277.	0.0	0.0
228.	59.00	MOTORING	278.	0.0	0.0
229.	29.59	MOTORING	279.	0.0	0.0
230.	20.00	30.00	280.	0.0	0.0
231.	20.71	30.00	281.	0.0	0.0
232.	23.03	24.66	282.	0.0	0.0
233.	25.34	40.13	283.	0.0	0.0
234.	24.34	74.85	284.	0.0	0.0
235.	23.00	40.58	285.	0.0	0.0
236.	24.00	70.00	286.	-0.00	-0.00
237.	24.00	70.00	287.	-0.00	-0.00
238.	24.71	65.43	288.	-0.00	-0.00
239.	25.00	66.15	289.	-0.00	-0.00
240.	29.00	62.28	290.	-0.00	-0.00
241.	31.36	87.67	291.	-0.00	-0.00
242.	37.00	90.00	292.	-0.00	-0.00
243.	30.77	90.00	293.	-0.00	-0.00
244.	34.00	90.00	294.	-0.00	-0.00
245.	34.00	90.00	295.	-0.00	-0.00
246.	34.00	90.00	296.	-0.00	-0.00
247.	34.00	46.39	297.	-0.00	-0.00
248.	32.06	20.00	298.	-0.00	-0.00
249.	31.63	14.40	299.	-0.00	-0.00