FINAL REPORT

TEMPERATURE TESTING AND ANALYSIS OF THE VACUUM ADVANCE DISCONNECT EXHAUST EMISSION CONTROL

PREPARED UNDER CONTRACT ARB 1086
WITH
STATE OF CALIFORNIA
AIR RESOURCES BOARD

By:

Northrop Corporation Electro-Mechanical Division **NORTHROP**

IN ASSOCIATION WITH OLSON LABORATORIES, INC

TL
214
.P6
T4

73Y13

TEMPERATURE TESTING AND ANALYSIS OF THE VACUUM ADVANCE DISCONNECT EXHAUST EMISSION CONTROL

Final Report

Prepared Under
Contract ARB-1086

with

State of California
Air Resources Board

Approved by

R. L. Gibney, Vice President
Environmental Systems

15 December 1972

NORTHROP CORPORATION
Electro-Mechanical Division
500 East Orangethorpe Avenue
Anaheim, California 92801

in association with

OLSON LABORATORIES, INC.

LIBRARY
AIR RESOURCES BOARD
P. O. BOX 2815
SACRAMENTO, CA 95812

FOREWORD

The Vacuum Advance Disconnect (VAD) technique is an exhaust emission control method presently being applied to pre-1966 Model Year (uncontrolled) cars in California. In conjunction with other techniques VAD is also a proposed method for emission control on 1966 to 1970 (controlled) Model Year vehicles. The terms "controlled" and "uncontrolled" refer to the presence or lack of exhaust emission control systems on cars delivered in California.

The Air Resources Board (ARB) staff and the Technical Advisory Committee (TAC) have presented estimates regarding the immediate benefits if a suitable "used car" device were available, and the subject device was immediately installed on a large number of all of these vehicles. The California Legislature has passed a bill which will require all 1966 and newer vehicles to have a device by 1973, which controls oxides of nitrogen.

VAD devices have been tested from an emissions effectiveness point of view and have proven effective. However, doubts have been raised about driveability and operational problems that may be created after installation of VAD devices. The Northrop Corporation, Electro-Mechanical Division, in association with Olson Laboratories, Inc., was selected to perform the temperature testing and analysis of the vacuum advance disconnect exhaust emission control study to evaluate the temperature effect of VAD on vehicles. Standard Agreement Number ARB-1086 was consummated on 5 May 1972.

This report documents the results and analysis on the testing of one hundred (100) uncontrolled and one hundred (100) controlled vehicles.

TABLE OF CONTENTS

Section		Page
1	INTRODUCTION	1-1
2	SUMMARY	2-1
	2.1 Program Narrative	2-1
	2.2 Results	2-2
3	TECHNICAL REPORT	3-1
	3.1 Vehicle Selection and Acquisition	3-1
	3.2 Engine Temperature Evaluating Testing Program Description	3-4
	3.2.1 Background	3-5
	3.2.2 Environmentally Controlled Circulation Air Technique	3-7
	3.2.3 Preparation for the Test	3-10
	3.2.4 Temperature Test System Operation	3-13
	3.2.4.1 Test Procedure	3-13
	3.2.4.2 Test Flow Schedule	3-16
	3.2.4.3 Problems Encountered	3-16
	3.3 Program Evaluation and Results	3-20
	3.3.1 Vehicle Boilovers	3-20
	3.3.1.1 Boilover by Auto Make	3-27
	3.3.1.2 Boilover by Vehicle Gross Weight	3-27
	3.3.1.3 Boilover by Engine CID	3-30
	3.3.1.4 Boilover by Engine Loading	3-35
	3.3.2 Vehicle Temperature Statistics	3-40
	3.3.2.1 Vehicle Temperature by Engine Class	3-47
	3.4 Conclusions	3-55
4	REFERENCES	4-1
	APPENDIX A - DYNAMOMETER CALIBRATION	A-1
	APPENDIX B - TEST DATA FORMAT	B-1
	APPENDIX C - TEST FORM INSTRUCTION	C-1
	APPENDIX D - VEHICLE TEMPERATURE DATA	D-1
	APPENDIX E - VEHICLE INFORMATION DATA	E-1

LIST OF ILLUSTRATIONS

Figure		Page
3-1	Testing Facility - Environmentally Controlled Room with Recirculating Air	3-9
3-2	Engine Thermocouple Installation	3-12
3-3	Flow Schedule for the VAD Temperature Test .	3-17
3-4	Boil-over Statistics by Car Make	3-29
3-5	Boil-over Statistics by Vehicle Gross Weight	3-32
3-6	Boil-over Statistics by Engine CID	3-34
3-7	Controlled Vehicles Statistics by Engine CID	3-36
3-8	Uncontrolled Vehicles Statistics by Engine CID	3-37
3-9	Boil-over Statistics by Grade Horsepower ...	3-39
3-10	Boil-over Statistics by Slope of the Grade .	3-42

LIST OF TABLES

Table		Page
2-1	Summary of Vehicle Boil Overs	2-4
2-2	Summary of Average Baseline Temperatures and Summary of Temperature Differences with VAD	2-5
3-1	The 200 - Vehicle Sample for VAD Temperature Program	3-3
3-2	Vehicle Selection by Engine Class	3-5
3-3	Test Results Performed to Determine the Vehicle Loading	3-5
3-4	Controlled Vehicle Boil Over	3-22
3-5	Uncontrolled Vehicle Boil Over	3-23
3-6	Statistical Data on Boil Overs by Car Make .	3-28
3-7	Statistical Data on Boil Overs by Vehicle Gross Weights	3-31
3-8	Statistical Data on Boil Over by Engine CID.	3-33
3-9	Statistical Data on Boil Over by Engine Loading	3-38
3-10	Vehicle Statistic by Road Grade	3-41
3-11	Temperature Data Summary on Total Fleet	3-45
3-12	Temperature Data Summary on Class A Vehicles (Under 200 CID)	3-48

LIST OF TABLES (Continued)

Table		Page
3-13	Temperature Data Summary on Class B Vehicles (200-249 CID)	3-49
3-14	Temperature Data Summary on Class C Vehicles (250-299 CID)	3-50
3-15	Temperature Data on Class D Vehicles (300-349 CID)	3-51
3-16	Temperature Data on Class E Vehicles (350-399 CID)	3-52
3-17	Temperature Data on Class F Vehicles (400 and Up CID)	3-53

SECTION 1

INTRODUCTION

The purpose of this study was to examine the temperature changes on vehicles after their vacuum advance circuits were disconnected. The technique which was evaluated was straight vacuum advance disconnect without any thermal override or other method of modulating the VAD. Previous studies indicated that an appreciable amount of exhaust emission can be reduced by disconnecting the vacuum advance at the appropriate time of the driving cycle. Two emission control devices are presently certified in California utilizing this principle. These devices included programmed thermal override based on monitoring coolant system temperatures. The same degree of emission effectiveness can be achieved by simply disconnecting the vacuum advance on uncontrolled vehicles. However, doubts have been raised about the vacuum advance disconnect (VAD) as to the resulting boil-over and valve damage which may be encountered if the vacuum advance is disconnected under all operating conditions.

This report documents the results of testing 100 controlled and 100 uncontrolled vehicles. The test utilized a constant 50 mph loaded condition (as defined in section 3.2.1) and idle test at 80°, 90°, and 100° F environments. Temperatures at various locations on the vehicle were compared with and without the vacuum advance disconnected, and statistical analyses of the data were performed.

This study was performed under contract to the State of California, Air Resources Board, Standard Agreement ARB-1086. The report was compiled by the Northrop Corporation Environmental Systems, in association with Olson Laboratories, Inc., at Anaheim, California.

SECTION 2

SUMMARY

2.1 PROGRAM NARRATIVE

Based on the present California vehicle population, one hundred (100) each randomly selected, controlled and uncontrolled vehicles of various makes, engine size and model year, were selected from those previously tested and serviced in the Mandatory Vehicle Emission Inspection and Maintenance Study. Each vehicle was then checked and/or adjusted to the manufacturer's specifications. Thermocouples were installed at the following locations to record the temperatures:

(a) In front of the radiator for ambient air intake temperature.

(b) At the air cleaner inlet for carburetor air intake temperature.

(c) At the radiator inlet for coolant water in temperature.

(d) At the radiator outlet for coolant water out temperature.

(e) At the end of the oil dip stick for engine oil temperature.

(f) At the wall of the heat-riser pipe for exhaust gas temperature.

(g) Inside of the tailpipe for exhaust gas temperature.

Baseline temperature tests (with vacuum advance connected) at ambient temperatures of 80°, 90° and 100° F in a controlled temper-

ature environment were performed at 50 mph and at idle. The baseline test was alternated with the identical procedure after disconnecting the vacuum advance. At the end of the tests, the vehicle was removed from the dynamometer and thermocouples disconnected. After being restored to its original condition, the car was returned to its owner.

2.2 RESULTS

Detail discussion on temperature differences due to vacuum advance disconnect follows in Section 3.3 and is summarized here.

- Ten of the controlled vehicles boiled over; 70% of the boilovers can be attributed to the the VAD (Table 2-1).

- Eighteen of the uncontrolled vehicles boiled over; 33.3% of the boilovers can be attributed to the VAD (Table 2-1).

- One vehicle exhibited an excessive increase in exhaust gas temperature with VAD which forced the termination of the test.

- Two vehicles exhibited an excessive increase in oil temperature with VAD which forced the termination of the test.

- Average exhaust temperatures increased approximately 9.5% with VAD under load, and about 5.6% with VAD at idle. They were slightly higher for

controlled than for uncontrolled cars with the exception of exhaust pipe wall temperature at idle for controlled cars which increased only 4%. Average baseline temperatures and average differences with VAD are shown in Table 2-2.

- For controlled vehicles, the coolant temperature did not show significant variation.

- Engine oil temperatures decreased slightly when vacuum advance was disconnected.

- Monitored temperatures generally increased as the ambient temperature increased.

- Nine percent (9%) of the controlled group and 19% of the uncontrolled group were found to have inoperative vacuum advance mechanisms in the "as received" condition.

Table 2-1. SUMMARY OF VEHICLE BOIL OVERS

GROUP	VEHICLE NUMBER	80°F		90°F		100°F	
		Baseline	With VAD	Baseline	With VAD	Baseline	With VAD
Controlled	122						*
	128		*				
	130					*	*
	131			*	*		
	134						*
	146					*	*
	153				*		
	154						*
	184						*
	188						*
Uncontrolled	007						*
	017	*	*				
	021	*	*				
	028					*	*
	030				*		
	039				*		
	044						*
	053			*	*		
	058						*
	059	*	*				
	066	*	*				
	068	*	*				
	069						*
	078	*	*				
	080					*	
	084					*	*
	088			*	*		
	097	*	*				

* Boil over.

Table 2-2. SUMMARY OF AVERAGE BASELINE TEMPERATURES AND SUMMARY OF TEMPERATURE DIFFERENCES WITH VAD

		CONTROLLED CARS		UNCONTROLLED CARS	
		Baseline Temperature W/O VAD	Temperature Difference With VAD	Baseline Temperature W/O VAD	Temperature Difference With VAD
Exhaust Temperature at Heat Riser	Loaded	748.48	75.24	697.34	56.36
	Idle	536.28	19.15	453.49	25.68
Exhaust Temperature at Tailpipe	Loaded	593.35	67.88	578.34	45.48
	Idle	350.78	25.89	310.30	19.17
Coolant in Temperature	Loaded	196.43	0.65	193.54	-1.74
	Idle	216.24	1.15	213.86	1.27
Coolant out Temperature	Loaded	186.08	0.39	182.73	-1.63
	Idle	204.58	1.20	202.23	0.94
Oil Temperature	Loaded	237.62	-1.83	241.01	-4.12
	Idle	232.39	-0.70	231.04	-2.83

SECTION 3

TECHNICAL REPORT

To evaluate the temperature effects resulting from inhibiting the vacuum advance on vehicles, it was necessary to perform temperature comparison testing before and after the modification was made. Northrop Corporation, in conjunction with Olson Laboratories, Inc., conducted this comprehensive temperature testing program. Major phases of the program are discussed below. For clarity and convenience, the technical report is divided into the following sub-sections:

- Vehicle selection and acquisition
- Engine temperature evaluation testing program description
- Program evaluation and results
- Conclusion

3.1 VEHICLE SELECTION AND ACQUISITION

During the 1320-vehicle test program recently completed as part of the total Vehicle Emission Inspection and Maintenance Study, some of the vehicles were volunteered by Northrop employees. Based on California vehicle distribution, the required 1320 vehicles were selected, tested, serviced, and evaluated. When released from the program, each of these operated within the emission limits established for the overall program. Those requiring corrective action were retested and qualified. Consequently, all vehicles were eligible for application to this program. A few

vehicle types were not available from the previously tested sample, but a wide selection was still available from other EPA test programs. The one hundred controlled and one hundred uncontrolled vehicles were thus conveniently obtained thereby minimizing program cost.

Table 3-1 presents a tabulation of the vehicle mix used for this test program. Table 3-2 shows the selection by engine class.

The vehicles used were generally in good mechanical condition, although some repairs and adjustments were necessary. All vehicles entering the temperature test were adjusted to manufacturer's specification. In addition, all radiator caps and vacuum advance diaphragms were inspected to insure meaningful test data. Defective radiator caps and vacuum diaphragms were replaced.

The participants in this program received a $10.00 cash incentive in addition to the necessary adjustment and repair. An overnight loan car was also provided. The test vehicles were returned to their owner the next day immediately after testing.

Early models of six-cylinder Ford products and pre-1966 Volkswagens were excluded in this program because these models lack the centrifugal advance devices. Since all advances on these vehicles are provided by the distributor vacuum, disconnecting such devices may have damaged the engines.

Table 3-1. THE 200 - VEHICLE SAMPLE FOR VAD TEMPERATURE PROGRAM

MAKE MODEL	70	69	68	67	66	TOTAL	65	64	63	62	61	60-57	TOTAL
BUICK	1	1	1	1	1	5	1	1	1	3	1		7
Special						0	2						2
CADILLAC					2	2			1			1	2
CHEVROLET	2	3	1	2	1	9	2	2	3	2	2	2	13
Chevelle		1	1			2	3						3
Corvair						0							0
Chevy II		1		1	1	3		2	4				6
Camaro		1	1	1		3							0
CHRYSLER		1	1	1		3		1	1				2
DODGE		1	3	2	1	7	1		1	1			3
Dart			1			1	1	2	3				6
FORD	3	3	2		2	10	2	2	4	1			9
Falcon						0		1			1		2
Fairlane				1	1	2		1					1
T-Bird				2		2			1			1	2
Mustang		1	1	1	2	5	2						2
MERCURY	1		1		1	3	2		1		1		4
Comet						0			1	1			2
Cougar	1	2	1	1		5							0
Lincoln						0					1		1
OLDSMOBILE		1				1	1	1	1			1	4
F-85	1		1	1	2	5	1	3		1			5
PLYMOUTH	1	2	1	1	1	6	2		2	1			5
Valient	1		1		1	3		1	1				2
PONTIAC	1	1	1	1		4	2		1			2	5
Tempest	1		2		1	4	1	1		1	1		4
Firebird						0							0
AMERICAN MOTORS		1	2			3	1	2	3	1			7
VOLKSWAGEN	1	1				2							0
P/C-6			1			1							0
Toyota	1	1	1	1	1	5							0
Datsun	1	3				4	1						1
TOTALS	16	25	24	17	18	100	25	20	29	12	7	7	100

3.2 ENGINE TEMPERATURE EVALUATING TESTING PROGRAM DESCRIPTION

3.2.1 Background

To provide realistic results, the test or driving cycle chosen for temperature evaluation must simulate portions of the road loads and speeds encountered by the average motorist. There are many conditions which tend to stress the engine (such as stop-and-go city driving on a warm day, hill climbing on regular interstate highways, and prolonged idling or stopping after a moderate to heavy road load operation). A logical, simple and repeatable test was desired, which would relate to some or all of the "real world" stresses which the vehicle population would encounter.

A steady-state condition, which could be economically simulated in the laboratory was chosen. It provided repeatable and meaningful temperature data.

The test is a 50 mph steady-state operation, simulating an uphill grade. The Division of Highways indicates that present day highways are designed for a maximum grade of 6.44 percent. Such a grade occurs on Interstate 5 at Grapevine. During summer months, many vehicles overheat when climbing this grade in daylight hours when high temperatures prevail. Fewer vehicles overheat in stop-and-go city traffic in similar temperatures. Hence, a driving cycle to simulate hill climbing appeared both to be the most severe test of heating load and the most desirable for test implementation. Since different vehicles will handle different load conditions without significant change in full advance, some tests were performed to determine the load at which the vehicles should be operated.

An investigation of road horsepower requirements for a 3,000 pound vehicle climbing a three percent grade at 50 mph yielded the following results:

$$HP = \frac{V.\ L.\ W.}{550\ ft - lb/sec}$$

$$= \frac{(5/6 \times 88\ ft/sec)\ (3\ ft/100\ ft)\ (3000\ lb)}{550\ ft - lb/sec}$$

$$= 12\ HP$$

Where: V = Velocity in feet per second

L = Grade lift in feet per hundred feet

W = Vehicle weight

To this the horsepower due to wind resistance and rolling friction must be added. This value for wind resistance is approximately 6.7 HP for a 3,000 pound vehicle.

A test on a 1969 Plymouth Valiant weighing 3,000 pounds was performed on the roll dynamometer in the laboratory. The car was equipped with a 6-cylinder engine rated at 115 HP. The purpose of this test was to determine the distributor vacuum available at 6.7 HP (level road), 18.7 HP (3 percent grade), and 30.7 HP (6 percent grade) all at 50 miles per hour. Results of this test are shown in Table 3-3. As can be seen, nearly full advance occurs at level road and three percent grade conditions. However, at six percent grade, the advance dropped from 30° to 17°.

Table 3-2. VEHICLE SELECTION BY ENGINE CLASS

VEHICLE TYPE \ CID	UNDER 200	200 to 249	250 to 299	300 to 349	350 to 399	400 and Up	TOTAL
Controlled	12	4	14	21	34	15	100
Uncontrolled	18	11	20	16	26	9	100

Table 3-3. TEST RESULTS PERFORMED TO DETERMINE THE VEHICLE LOADING (1969 Plymouth Valiant, 115 HP, 170 Cubic-Inch, 6-Cylinder)

MPH	ROAD HP	PERCENT GRADE	DISTRIBUTOR VACUUM	TIMING DEGREES	RPM
50	6.7	0	13.5 in. Hg	30	2200
50	18.7	3	9.5 in. Hg	29	2200
50	30.7	6	5.0 in. Hg	17	2200

Based on this experiment it was decided that one steady-state test be performed. The vehicles were loaded on dynamometer until spark advance began to drop approximately 1° from full advance. This nearly full advance, when disconnected would then contribute significant performance differences and provide the maximum difference in observed temperature changes.

3.2.2 Environmentally Controlled Recirculation Air Technique

Since only the radiator and the engine performance would affect the test temperatures, a technique was developed to apply temperature controlled air only to the front part of the vehicles. Air was supplied by an 18,000 CFM blower to the exit grill placed directly in front of the radiator. The size of the exit is approximately four square feet, providing a wind velocity of 50 miles per hour. The size of the exit nozzle was selected to fit all vehicle radiators. The exit nozzle was adjustable in height and was provided with a shutter type damper in front of it.

The heated air was directed toward the radiator during 50 mph road load conditions. A roll dynamometer was used to simulate road load conditions. Since the position of the dynamometer was fixed, the length of the duct exit nozzle was adjustable to fit all vehicle lengths.

The temperature tests were performed within an enclosed, environmentally controlled room with the simulated wind applied to the radiator and engine. The heated air, after passing by the vehicle, was recirculated through a duct within the test facility. An 80 KVA heater was installed in the duct between the blower and the vehicles. The heater, in conjunction with a system of dampers

in the ducting, was used to control air temperature by blending outside air and recirculated air. Thus, power requirements were minimized. Two thermostats, one located mid-way on the return duct for return air adjustment, and the other located at the exit nozzle for exit air adjustment, were provided for accurate temperature control for the tests.

The configuration and equipment required is shown in Figure 3-1. The environmentally controlled recirculation air technique was used because:

(a) It simulates actual road conditions for the radiator and the engine.

(b) It requires minimum electrical power, thus reducing installation and operating costs.

(c) It reduces interference with other operations by reason of being enclosed.

The exhaust gas was first diluted by outside air and exhausted to the outside atmosphere through the ceiling. A 1800 CFM blower was utilized to ensure positive flow.

In order to provide a safe and comfortable environment for the operators, the duct fan system was carefully designed to ensure that the CO concentration in the enclosed test room was below the Federally specified toxic level. A minimum amount of outside air was mixed with the return air at all times. In addition, a separate blower was employed to supply outside air directly overhead of the operator. Since the outside air was cooler than the maximum of 100° F operating temperature, the comfort of the operator as well as his safety was also achieved. The CO level was checked periodically to assure that the room air CO concentration was within acceptable limits.

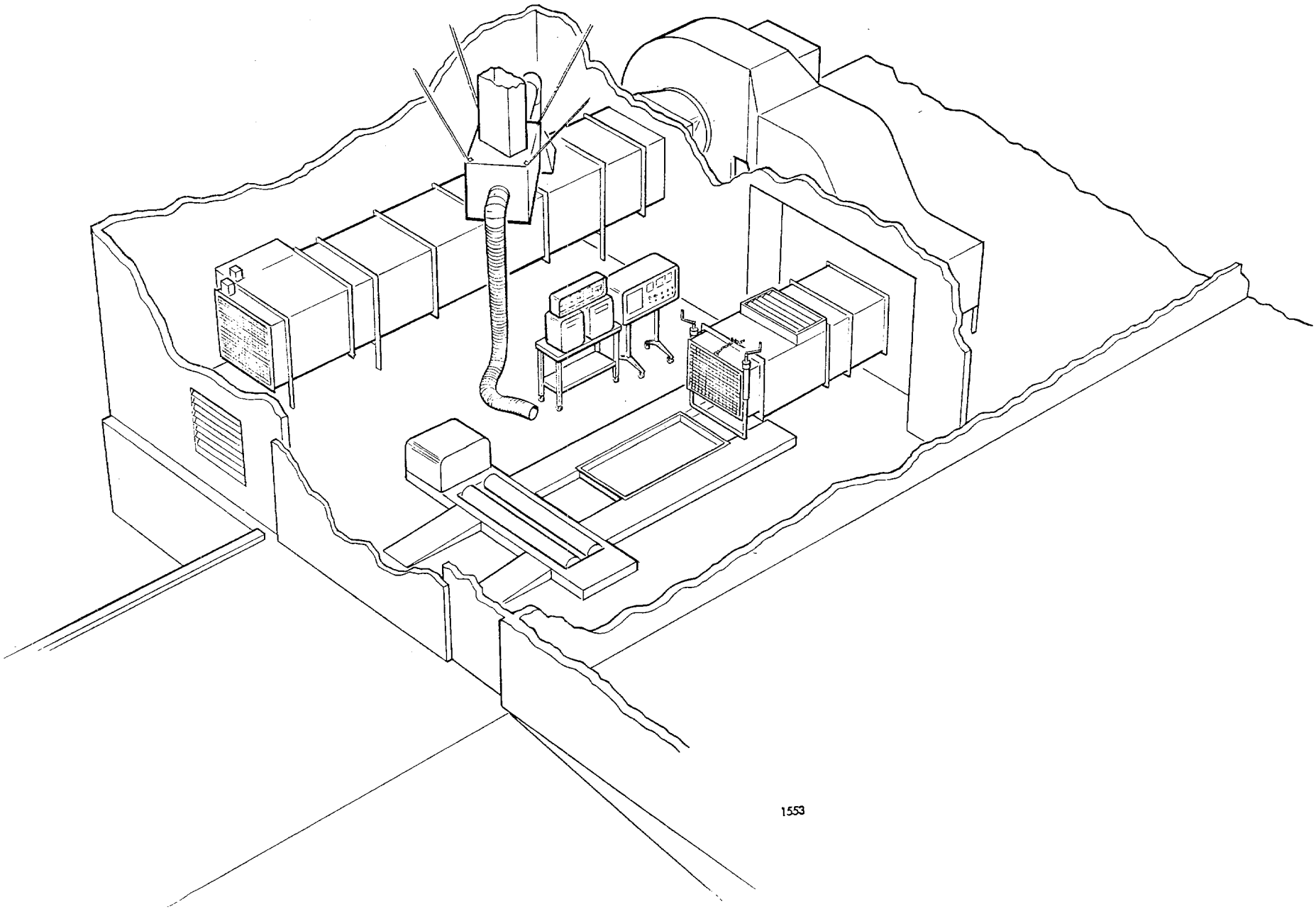


Figure 3-1. TESTING FACILITY - ENVIRONMENTALLY CONTROLLED ROOM WITH RECIRCULATING AIR

3.2.3 Preparation for the Test

As soon as the test vehicle was acquired, the mechanic observed the overall vehicle condition to determine the acceptance or rejection of the vehicle. Upon acceptance, the participant was provided a loan car if necessary, and the vehicle was thoroughly inspected. Repair and adjustments listed below were performed to ensure that the testing specifications were met.

- Check the vacuum advance diaphragm, and replace if necessary. This is the key point for the test. If the vacuum is not working, there is essentially VAD at all times.

- Check engine performance specifications, adjust if necessary.

- Adjust idle timing to manufacturer's specification.

- Adjust idle engine speed to manufacturer's specification.

- Check the level of the engine lubrication oil, add oil if necessary.

- Check radiator coolant level, fill to level.

- Inspect condition of radiator hoses and heater hoses, replace if necessary.

- Inspect transmission fluid level on vehicles with automatic transmission with engine on and warmed up, add fluid if necessary.

- Check the condition and tensions on all belts, adjust and/or replace if necessary.

- Check tires to insure good running condition. Bare and new tires should not be used because of the severe load and temperature conditions. Inflate all tires to 45 psi for the test.

- Inspect exhaust system. Listen for loud leaky exhaust. Physically inspect for leaks and restrict exhaust to check for leaks. Reject or repair exhaust system as required.

- Check brakes for pedal play and hydraulic leaks in the system.

- Record inspection data and actions taken.

All vehicle inspections conformed strictly to manufacturer's specification. In the cases when information was not available, common mechanic's practice was exercised.

Type "J" (iron constantan) thermocouples were then installed on the vehicles as shown in Figure 3-2, at the following locations:

(a) In front of the radiator for ambient air intake temperature.

(b) At the air cleaner inlet for carburetor air intake temperature.

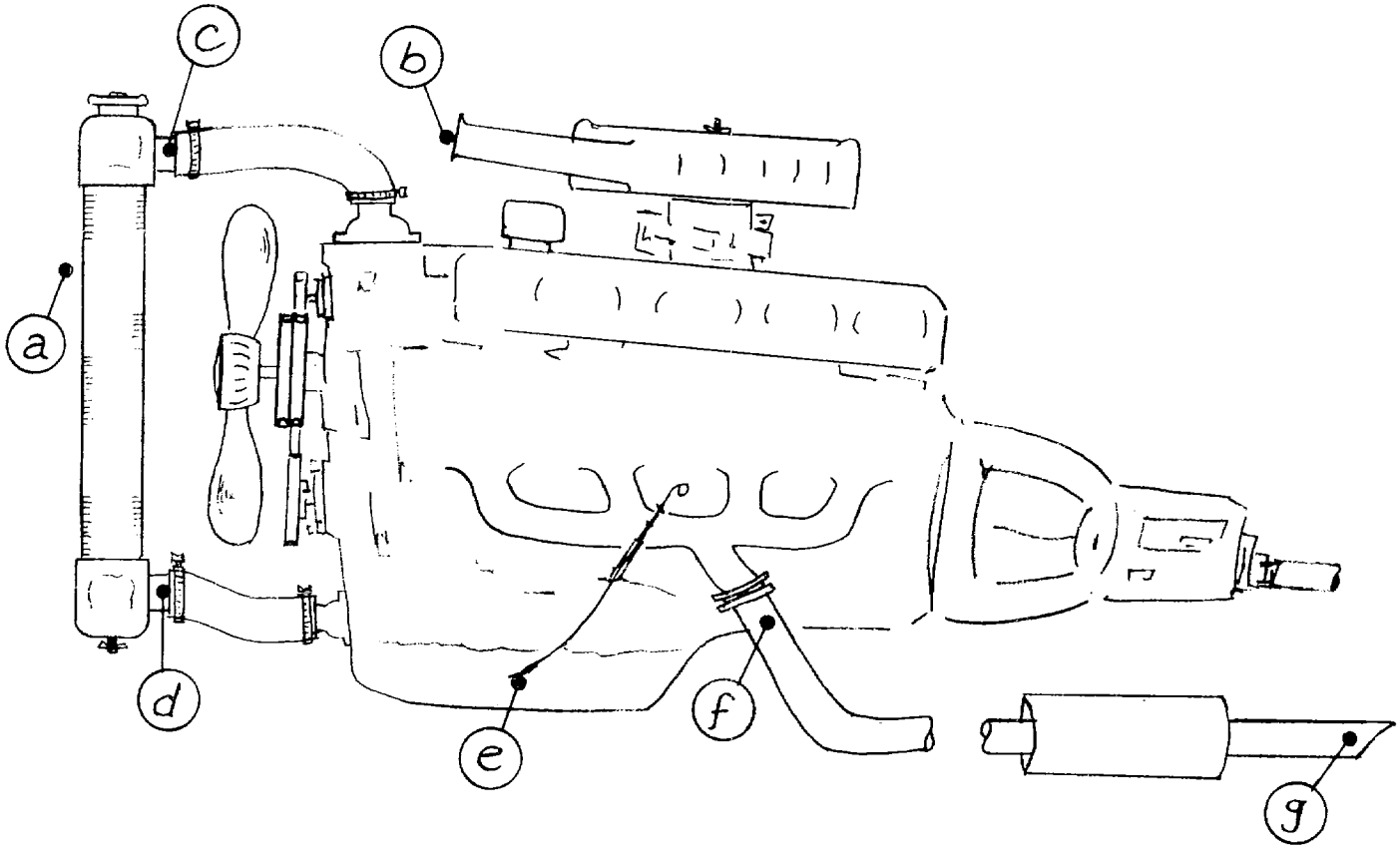


Figure 3-2. ENGINE THERMOCOUPLE INSTALLATION

(c) At the radiator inlet for coolant water in temperature.

(d) At the radiator outlet for coolant water out temperature.

(e) At the end of oil dip stick for engine oil temperature.

(f) At the wall of heat-riser pipe for exhaust gas temperature.

(g) Inside of tailpipe for exhaust gas temperature.

All thermocouples were equipped with quick connector plugs for the recorders. In addition to the temperatures monitored, connections were provided for measurement of:

- Distributor vacuum in inches of Hg
- Manifold vacuum in inches of Hg
- Engine speed in RPM
- Engine timing in degrees
- Dynamometer loading

Quick disconnect of vacuum lines was also provided during vehicle preparation. All recorders and instruments were serviced and calibrated every thirty days to insure data accuracy. The dynamometer was calibrated every sixty days to assure the proper loading for the vehicles.

3.2.4 Temperature Test System Operation

3.2.4.1 Test Procedure

The vehicle, after being prepared for the test, was positioned on the roll dynamometer and securely tied down to the floor by chain.

The exhaust was connected to the exhaust fan. The thermocouples were connected to the recorders and the vacuum hoses and timing wires were connected to an Autoscan analyzer. The outside ambient conditions before the test were also recorded. While the vehicle and the dynamometer were warming up, the heater of the fan duct system heated the room air to the required equilibrium temperature with the outside air shutter closed.

The dynamometer was loaded as discussed in Section 3.2.1, and engine data (timing, speed, distributor vacuum, manifold vacuum) were recorded with and without vacuum advance disconnected. The vehicles with air conditioning were operated with air conditioning on.

When the temperature of the fan exit air reached the required equilibrium temperatures (80°, 90° or 100° F), the test was conducted on the dynamometer. Since the engine generated a considerable amount of heat, the temperature would reach equilibrium in a very short period of time. A thermostat sensed this increase in temperature and operated an air cylinder to open the outside air shutter. This dynamic balance of heat provided the necessary response to control the temperature.

The temperature test was started with 50 mph loaded condition at 80° F without VAD for ten minutes, followed by a five minute idle condition at the same temperature. Idling air was achieved by diverting the airflow upward with a bypass shutter and by closing the exit nozzle shutter. The test was repeated with VAD and then both cycles (with and without VAD) repeated at 90° and 100° F temperatures.

Tests were discontinued if any of the following conditions occurred:

- Excess exhaust temperature. This is indicated by the cherry red color of exhaust pipe and by the reading on the recorder. Testing was stopped to prevent possible valve or engine damage.

- Boil-over. Stop the test and cool the engine to normal operating temperature, continue the other phase of the test (with or without VAD) with the same temperature and stop test.

- Exhaust system failure. This involves safety of the testing personnel; it should be repaired if possible and continue testing. If irreparable, abort test.

- Tire failure. Replace spare tire and continue test. Reimburse owner with replacement tire.

- Temperature problem. On occasion, the outside ambient temperature would exceed the test temperature condition. Under these circumstances, the test was discontinued and rescheduled.

All temperatures and the "time to boil" were recorded during the test for further analysis. "Time to boil" is defined in this program as one of the following:

- Actual time to boil from the beginning of the idling mode if the vehicle boils over.

- Time to reach an equilibrium or maximum temperature during the idling mode.

- Five minutes; if the vehicle does not boil over or reach an equilibrium temperature at the end of the idling mode.

3.2.4.2 Test Flow Schedule

In order to perform the test most efficiently and effectively, a test flow schedule and test form instructions were generated.

The test form instructions (Appendix C) described all steps which each individual person should perform during the entire test (from acquiring the test vehicle to returning it to owner). This was done to insure that all necessary tasks were performed and precautions taken.

A test flow schedule was generated to minimize the time of the entire test cycle. This was important because of the tight test schedule required for this program. Maximum efficiency was necessary to complete the testing within the desired schedule. Figure 3-3 details the flow schedule for the VAD temperature test. With the cooperation of vehicle procurement, and mechanics, this flow schedule enabled the test personnel to complete three-vehicle testings in a single shift.

3.2.4.3 Problems Encountered

The major problem encountered during the testing period was a local heat wave in mid-summer. The ambient air temperature fre-

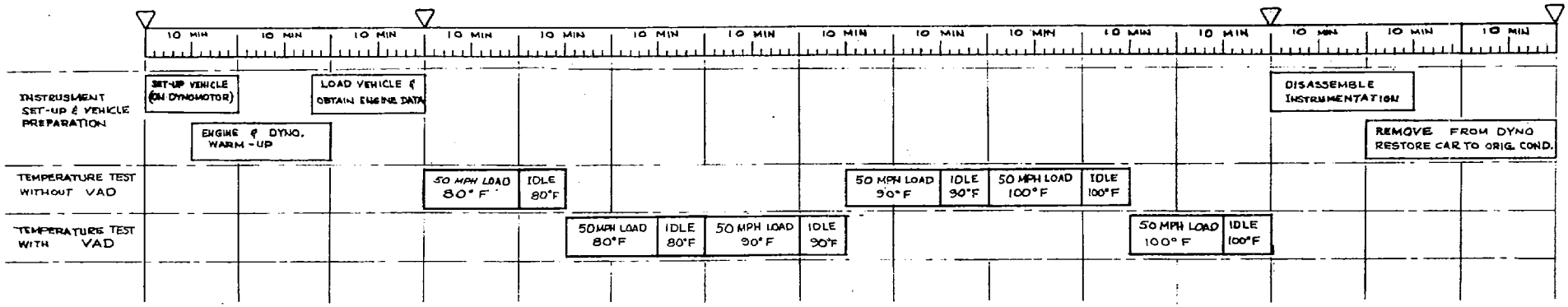


Figure 3-3. FLOW SCHEDULE FOR THE VAD TEMPERATURE TEST

quently exceeded 90° F by 9 o'clock in the morning. Since the only source of cooling capability of the fan duct system was the outside air, the lower operating temperature was limited by the ambient air temperature. The testing schedule was significantly delayed and several tests were aborted or determined to be invalid.

This problem was solved when the following changes were implemented:

(a) Raise the limiting temperature:

It was agreed with ARB that on a hot day with heat problems, the limiting temperature could be increased to 85° F without aborting the test. Unless the vehicle boiled over at this temperature, it did not require rescheduling for retest.

(b) Alter the testing schedule:

It was finally necessary to test the vehicles on a late night shift when the air temperature was cooler. Extra loan cars were needed because the time of possession was extended an extra day.

A tire failure problem was encountered in this program which was caused by the severe load condition imposed on tires by the dynamometer. It was found that certain types of tires were not suitable under these severe test conditions. At high temperature, high pressure and continuous loading on the dynamometer, some tires did not generate sufficient cooling by themselves and

failed. The problem was minimized by providing two fans directed toward the tires to prevent the heat buildup during the tests.

It was discovered on some 1958 to 1965 GM vehicles that the idle speed changed significantly with VAD and without VAD because of the dual-ported carburetor system. Normally, on these cars, the distributor experiences full vacuum at idle speed. When the vacuum was disconnected, the idle speed dropped signicantly. To maintain the idle at manufacturer's specification with VAD without readjusting the idle speed, it was necessary for the driver to advance the throttle until the idle speed returned to normal.

The tests of several vehicles were discontinued due to various reasons. They are listed as follows, together with the explanation for terminating the test.

- #012 - '61 Falcon (144 CID) - car misfiring and missing at 100° F with VAD during middle of test. Speed of 50 mph could not be achieved.

- #029 - '64 Ford (170 CID) - this vehicle exhibited an excessive increase in exhaust gas temperature with VAD which forced the termination of the test.

- #030 - '63 Impala (283 CID) - at 100° F with VAD oil and exhaust temperature rose too high whereas the cooling temperature decreased rapidly which indicated a failure in cooling system (possibly the water pump). The test was discontinued to avoid engine damage.

- #139 - '67 Tempest (326 CID) - oil temperature reached 100° F with VAD. Test was discontinued to avoid engine damage.

3.3 PROGRAM EVALUATION AND RESULTS

This section evaluates and discusses the results of the testing program. Vehicle boilovers are presented and discussed in detail. The statistical analysis of sample size and boilover are presented considering the effect of ambient temperature, model, make, vehicle weight, engine size, test loading on vehicle and percent grade of the slope. The effects of VAD on the engine boilover are also considered. The temperature differences caused by VAD are discussed by showing mean and standard deviations on all engine temperatures. In addition, the same comparison is done by engine classes.

It is interesting to note that 9% of the controlled vehicles and 19% of the uncontrolled vehicles had faulty vacuum advance mechanisms requiring replacement before testing.

3.3.1 Vehicle Boilovers

Vehicles tend to overheat and boil over due to the incapability of the radiator to cool the engine when the engine is stressed in extreme temperature (such as stop and go city driving on a warm summer day, hill climbing on regular interstate highways, and prolonged idling after a heavy road load operation).

The test cycle chosen was a ten minute, 50 mph, loaded condition followed by 5 minutes of idling. This was believed to be one of

the most severe cases leading to engine boilover since all the heat generated during the loaded condition would be imposed on the radiator during the idling condition. Heat transfer during idling is significantly reduced causing boilover.

A total of 28 vehicles boiled over during this 200-vehicle testing program. A summary of boilover statistics is shown in Tables 3-4 and 3-5. Also, detailed information on each of the vehicles is listed below:

(a) Ten of the controlled vehicles boiled over. 70% of these can be attributed to disconnecting the vacuum advance. This indicates that the vacuum advance disconnect has significant effect on engine boilover on controlled vehicles. For the vehicles that boiled over, 10% boiled over at 80° F, 20% boiled over at 90° F, and 70% of them boiled over at 100° F. This coincides with the expectation that boilovers would occur more often at high ambient temperatures. Most of the boilovers occurred during the idling mode. Approximately 20% of the boilovers occurred at 50 mph loaded condition. This may suggest that for controlled vehicles, the radiator usually would provide sufficient cooling during road condition regardless of vacuum advance disconnect. However, the imposed heat during idling mode with vacuum advance disconnected would overload the radiator and cause boilovers.

Table 3-4. CONTROLLED VEHICLE BOIL OVER

VEHICLE NUMBER	YEAR, MODEL	ENGINE CID	BOIL OVER (SECONDS AFTER)											
			Without VAD						With VAD					
			80°		90°		100°		80°		90°		100°	
			Loaded	Idle	Loaded	Idle	Loaded	Idle	Loaded	Idle	Loaded	Idle	Loaded	Idle
122	'67 Camaro	327	--	--	--	--	--	--	--	--	--	--	--	220
128	'66 GTO	389	--	--	--	--	--	--	--	270	--	--	--	--
130	'69 Cougar	351	--	--	--	--	--	36	--	--	--	--	--	179
131	'68 Cougar	302	--	--	*	--	--	--	--	--	*	--	--	--
134	'68 F-85	350	--	--	--	--	--	--	--	--	--	--	--	210
146	'69 Executive	400	--	--	--	--	--	237	--	--	--	--	*	--
153	'66 Nova	283	--	--	--	--	--	--	--	--	--	180	--	--
154	'66 Mustang	200	--	--	--	--	--	--	--	--	--	--	--	170
184	'66 Corona	1900 cc	--	--	--	--	--	--	--	--	--	--	--	120
188	'70 Plymouth Fury	383	--	--	--	--	--	--	--	--	--	--	--	270

* Boil over during 50 mph loaded condition.

Table 3-5. UNCONTROLLED VEHICLE BOIL OVER

VEHICLE NUMBER	YEAR, MODEL	ENGINE CID	BOIL OVER (SECONDS AFTER)											
			Without VAD						With VAD					
			80°		90°		100°		80°		90°		100°	
			Loaded	Idle	Loaded	Idle	Loaded	Idle	Loaded	Idle	Loaded	Idle	Loaded	Idle
007	'64 Buick	300	--	--	--	--	--	--	--	--	--	--	--	30
017	'65 Galaxie	390	--	10	--	--	--	--	--	10	--	--	--	--
021	'63 Riviera	425	*	--	--	--	--	--	*	--	--	--	--	--
028	'64 Mercury	390	--	--	--	--	--	181	--	--	--	--	--	201
030	'63 Impala	283	--	--	--	--	--	--	--	--	--	170	--	--
039	'63 Galaxie	352	--	--	--	--	--	--	--	--	--	270	--	--
044	'65 Datsun	1200 cc	--	--	--	--	--	--	--	--	--	--	--	170
053	'63 Custom 88	383	--	--	--	270	--	--	--	--	--	210	--	--
058	'65 Dart	225	--	--	--	--	--	--	--	--	--	--	--	300
059	'63 Nova	194	*	--	--	--	--	--	*	--	--	--	--	--
066	'62 Electra	401	--	240	--	--	--	--	--	300	--	--	--	--
068	'65 Special	300	--	120	--	--	--	--	--	180	--	--	--	--
069	'61 Pontiac	195	--	--	--	--	--	--	--	--	--	--	--	170
078	'63 Rambler	197	--	120	--	--	--	--	--	170	--	--	--	--
080	'64 Ford	390	--	--	--	--	--	240	--	--	--	--	--	--
084	'62 Cutlass	330	--	--	--	--	--	240	--	--	--	--	--	240
088	'63 Ford	352	--	--	--	140	--	--	--	--	--	120	--	--
097	'63 Galaxie	289	--	90	--	--	--	--	--	300	--	--	--	--

* Boil over during 50 mph loaded condition.

Following is a list of the vehicles that boiled over in the controlled fleet.

#122 - '67 Camaro (327 CID) - boiled over at 100° with VAD 220 seconds after idling.

#128 - '66 GTO (389 CID) - boiled over at 80° with VAD 270 seconds after idling.

#130 - '69 Cougar (351 CID) - boiled over at 100° with VAD 179 seconds after idling and without VAD 36 seconds after idling.

#131 - '68 Cougar (302 CID) - boiled over at 90° with and without VAD at loaded condition.

#134 - '68 F-85 (350 CID) - boiled over at 100° with VAD 210 seconds after idling.

#146 - '69 Executive (400 CID) - boiled over at 100° without VAD 237 seconds after idling and with VAD at loaded condition.

#153 - '66 Nova (283 CID) - boiled over at 90° with VAD 180 seconds after idling.

#154 - '66 Mustang (200 CID) - boiled over at 100° with VAD 170 seconds after idling.

#184 - '66 Corona (1900 CC) - boiled over at 100° with VAD 120 seconds after idling.

#188 - '70 Fury III (383 CID) - boiled over at 100° with VAD 270 seconds after idling.

(b) Eighteen of the uncontrolled vehicles boiled over. Only 33.3% of them can be attributed to disconnecting the vacuum advance. The balance (66.7%) boiled over both with and without VAD. This may suggest that either most of the uncontrolled vehicles tested were equipped with faulty cooling systems or the VAD does not increase the engine coolant temperatures as much

as in the case of the controlled vehicles. However, the exhaust temperature does increase and the effect of VAD will be discussed later in the exhaust temperature section.

Approximately 38.9% of the vehicles boiled over at 100° F, 22.2% of the vehicles boiled over at 90° F, and 38.9% of them boiled over at 80° F. This also suggested that bad or inadequate cooling systems are not uncommon among the uncontrolled vehicles in the selected test group. Disconnecting the vacuum advance did tend to insure the boilover and intensify the overheating problem. This is further indicated by the observation that all vehicles which boiled over at 80° F did so both with and without VAD, and two of them boiled over during the 50 mph loaded condition. Following is a list of the uncontrolled vehicles which experienced boilover.

#007 - '64 Skylark (300 CID) - boiled over at 100° with VAD 30 seconds after idling.

#017 - '65 Galaxie (390 CID) - boiled over at 80° with and without VAD 10 seconds after idling.

#021 - '63 Riviera (425 CID) - boiled over at 80° with and without VAD at loaded condition.

#028 - '64 Mercury (390 CID) - boiled over at 100° with VAD 201 seconds after idling.

#030 - '63 Impala (283 CID) - boiled over at 90° with VAD 170 seconds after idling.

#039 - '63 Galaxie (352 CID) - boiled over at 90° with VAD 270 seconds after idling.

#044 - '65 Datsun (1200 CC) - boiled over at 100° with VAD 170 seconds after idling.

#053 - '63 Custom 88 (383 CID) - boiled over at 90° with VAD 210 seconds after idling and without VAD 270 seconds after idling.

#058 - '65 Dart (225 CID) - boiled over at 100° with VAD 300 seconds after idling.

#059 - '63 Nova (194 CID) - boiled over at 80° with and without VAD at loaded condition.

#066 - '62 Electra (401 CID) - boiled over at 80° with VAD 300 seconds after idling and without VAD 240 seconds after idling.

#068 - '65 Special (300 CID) - boiled over at 80° with VAD 180 seconds after idling and without VAD 120 seconds after idling.

#069 - '61 Tempest (195 CID) - boiled over at 100° with VAD 170 seconds after idling.

#078 - '63 Rambler (197 CID) - boiled over at 80° with VAD 170 seconds after idling and without VAD 120 seconds after idling.

#080 - '64 Country Squire (390 CID) - boiled over at 100° without VAD 240 seconds after idling.

#084 - '62 Cutlass (330 CID) - boiled over at 100° with and without VAD 240 seconds after idling.

#088 - '63 Ford Custom (352 CID) - boiled over at 90° with VAD 210 seconds after idling and without VAD 140 seconds after idling.

#097 - '63 Galaxie (289 CID) - boiled over at 80° with VAD 300 seconds after idling and without VAD 90 seconds after idling.

3.3.1.1 Boilover by Auto Make

In order to investigate the boilover effect as a function of Auto Make, all test vehicles were divided into five groups, namely, American Motors Company, Chrysler Corporation, Ford Motors Company, General Motor Company and Foreign cars. The vehicle statistics which include sample size, boilover, and percentage of boilover are presented in Table 3-6 and plotted in Figure 3-4. It can be seen that General Motors had the largest sample size among both of the controlled and uncontrolled vehicles. The sample sizes for Ford Motors and Chrysler were similar. There were only three American Motor's products in controlled vehicles and one foreign car in uncontrolled vehicles so the results in these groups may not be representative.

Excluding these potentially non-representative data, Chrysler products experienced the least boilovers. Only one of the 20 controlled vehicles and one of the 18 uncontrolled vehicles boiled over. Ford Motor Company, on the other hand, experienced the most boilovers in percentage which includes 3 boilovers among the 27 controlled test vehicles and 6 boilovers among the 23 uncontrolled test vehicles. General Motors Company cars showed an average amount of boilover among their products in both controlled and uncontrolled groups.

3.3.1.2 Boilover by Vehicle Gross Weight

In order to determine the effect of vehicle gross weight on vehicle boilover, test vehicles were divided into weight classes similar to the ones specified by the Federal Register. The vehicle gross weights were plotted against the sample size, number

Table 3-6. STATISTICAL DATA ON BOIL OVERS BY CAR MAKE

VEHICLE MAKE	CONTROLLED VEHICLES			UNCONTROLLED VEHICLES		
	Sample Size	Boil Over	Percentage Boil Over	Sample Size	Boil Over	Percentage Boil Over
American Motors	3	1	33.3%	7	1	14.3%
Chrysler Corporation	20	1	5.0%	18	1	5.5%
Ford Motors	27	3	11.0%	23	6	18.0%
General Motors	38	4	10.5%	51	9	17.6%
Foreign Cars	12	1	8.3%	1	1	100.0%
Total	100	10	--	100	18	--

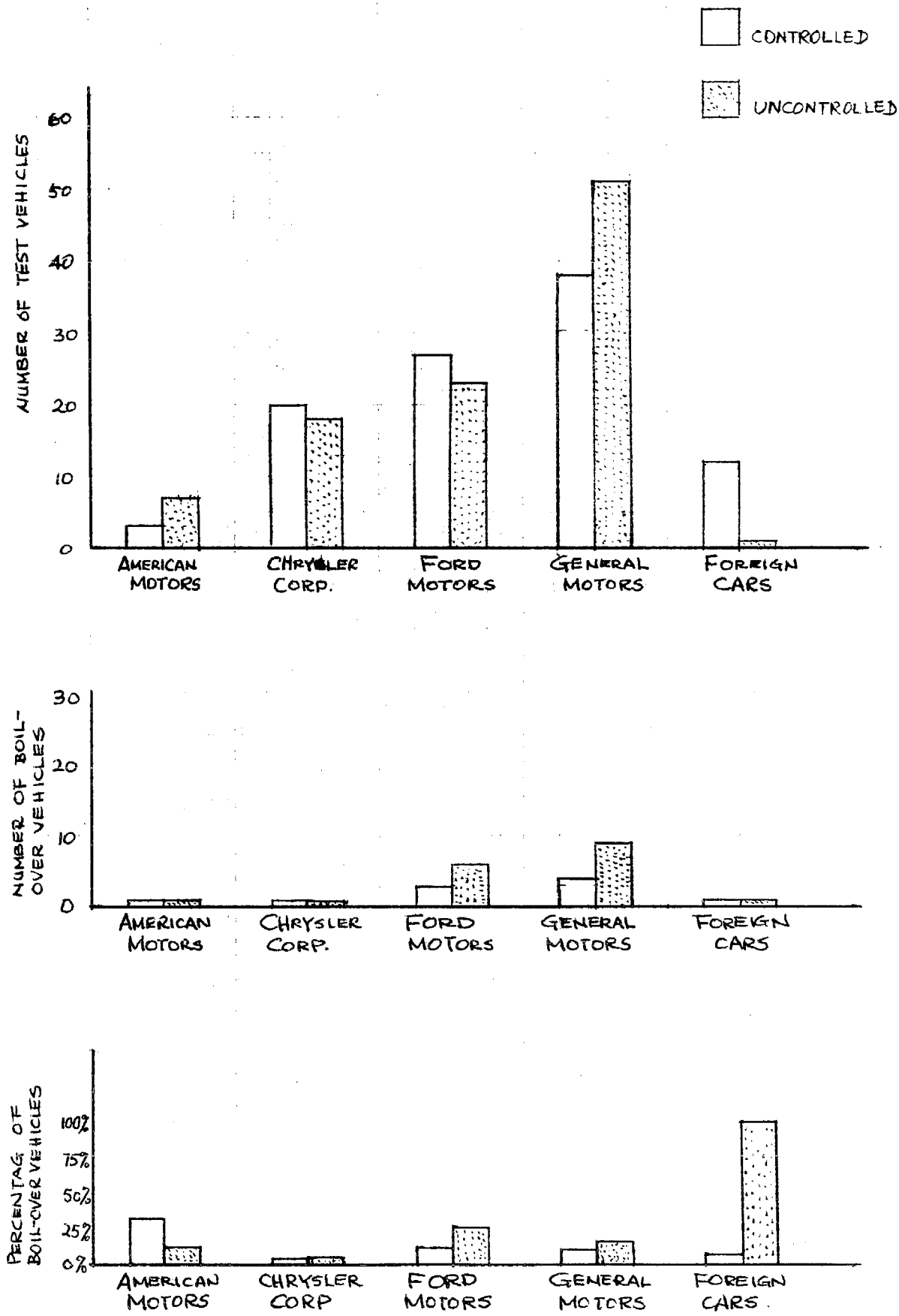


Figure 3-4. BOIL-OVER STATISTICS BY CAR MAKE

of boilovers and percentage of boilovers and presented in Figure 3-5. The numerical values are shown in Table 3-7.

The number of test vehicles were uniformly distributed between 3000 - 4500 pounds for both controlled and uncontrolled vehicles. The sample sizes for the extreme light and heavy vehicles were too small to support any strong conclusions. For the controlled vehicles, the boilover varied from 10% for the 4500-pound class to 25% for the 3000-pound class. For the uncontrolled vehicles, the span was even smaller, the percentages of boilovers were: 12.5% (3500#), 19.3% (3000#), 21.7% (4000#) and 22.2% (4500#). This suggests that the vehicle gross weight does not have a significant effect on vehicle boilovers.

3.3.1.3 Boilover by Engine CID

In order to determine the effect of engine size (CID) on boilovers, all the test vehicles were grouped into six (6) engine classes defined as follows:

Class	Displacement (Cubic Inches)
A	Under 200
B	200 - 249
C	250 - 299
D	300 - 349
E	350 - 399
F	400 and Up

The number of test vehicles, number of boilovers and percentage of boilovers are presented in Table 3-8 and plotted in Figure 3-6. It is seen that class E had the largest sample size both for controlled and uncontrolled vehicle groups. Class B had the smallest

Table 3-7. STATISTICAL DATA ON BOIL OVERS BY VEHICLE GROSS WEIGHTS

VEHICLE GROSS WEIGHT	CONTROLLED VEHICLES			UNCONTROLLED VEHICLES		
	Sample Size	Boil Over	Percentage Boil Over	Sample Size	Boil Over	Percentage Boil Over
2000	1	0	0	0	0	0
2250	3	1	33.3%	0	0	0
2500	8	0	0	2	1	50.0%
2750	0	0	0	4	0	0
3000	8	2	25.0%	26	5	19.3%
3500	27	2	7.4%	24	3	12.5%
4000	23	4	17.4%	23	5	21.7%
4500	24	1	4.2%	18	4	22.2%
5000	5	0	0	3	0	0
5500	1	0	0	0	0	0
Total	100	10	--	100	18	--

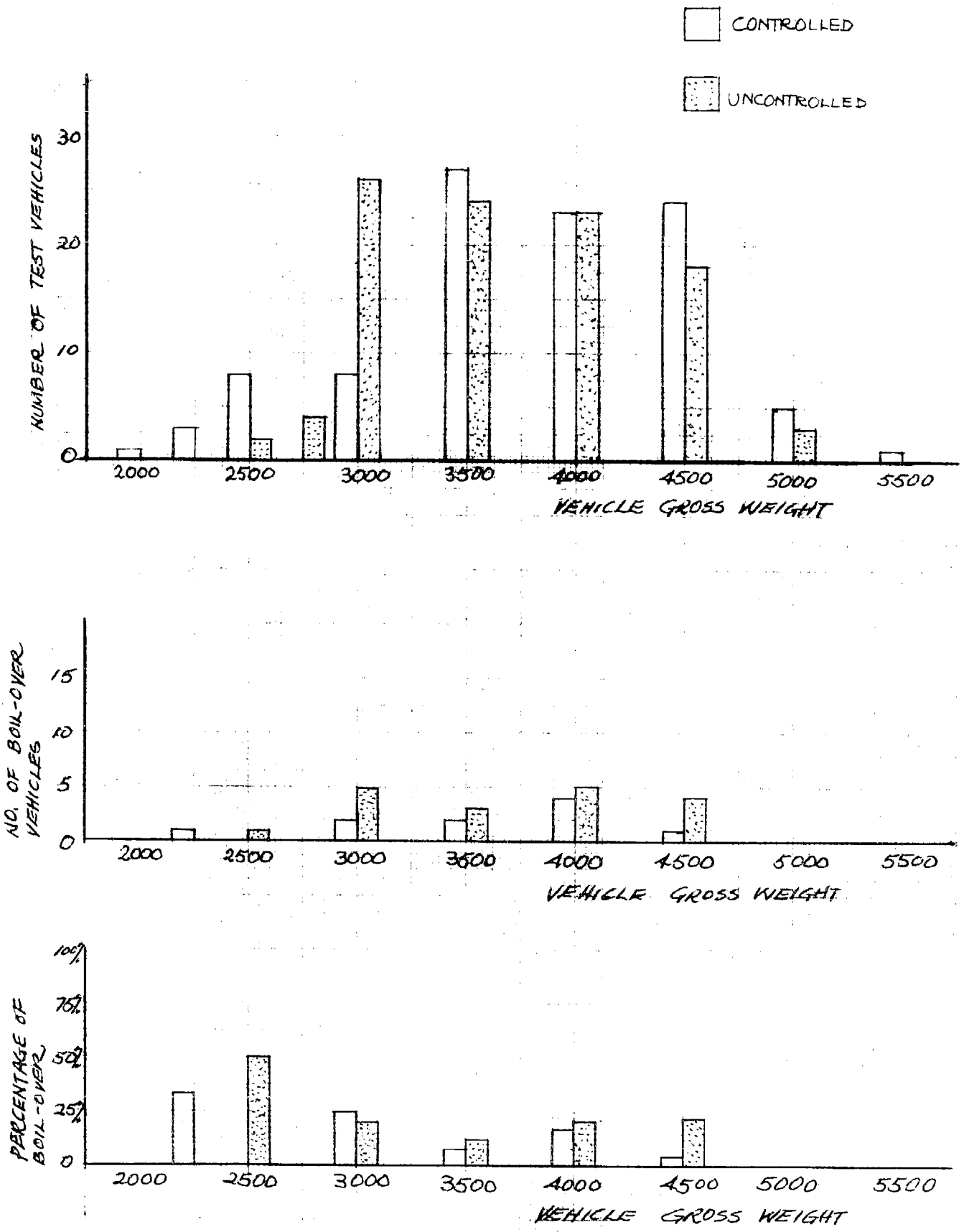


Figure 3-5. BOIL-OVER STATISTICS BY VEHICLE GROSS WEIGHT

Table 3-8. STATISTICAL DATA ON BOIL OVER BY ENGINE CID

ENGINE SIZE (CID)	CONTROLLED VEHICLES			UNCONTROLLED VEHICLES		
	Sample Size	Boil Over	Percentage Boil Over	Sample Size	Boil Over	Percentage Boil Over
Under 200	12	1	8.3%	18	4	22.2%
200 to 249	4	1	25.0%	11	1	9.0%
250 to 299	14	1	7.1%	20	2	10.0%
300 to 349	21	2	9.5%	16	3	18.8%
350 to 399	34	4	11.8%	26	6	23.8%
400 and Up	15	1	6.6%	9	2	22.2%
Total	100	10	--	100	18	--

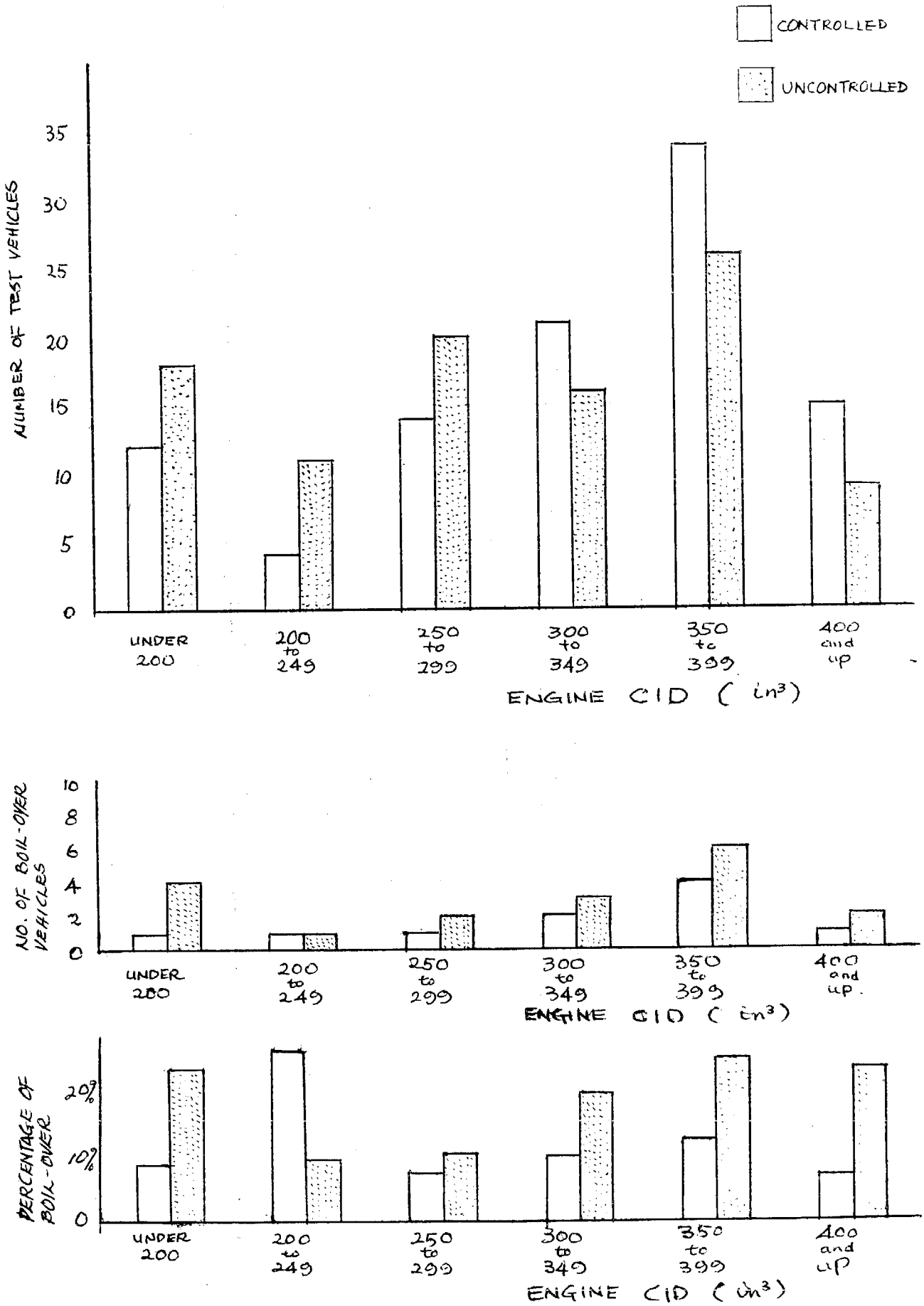


Figure 3-6. BOIL-OVER STATISTICS BY ENGINE CID

sample size for controlled groups and share the least sample size with class F in uncontrolled vehicles.

For the controlled vehicles, except for the class B all classes had a similar percentage of boilovers. As for the uncontrolled vehicles, class B and class C experienced approximately 10% boilover whereas the other classes experienced a 20% boilover percentage.

Figures 3-7 and 3-8 present the boilover statistics by exact engine CID for controlled and uncontrolled vehicles. For controlled vehicles, the boilovers are spread quite uniformly across the engine CID as shown before. However, for uncontrolled vehicles, more boilovers were experienced by engine sizes of 308, 352 and 390 CID. This may suggest that these engines are particularly vulnerable to the adverse effect of VAD.

3.3.1.4 Boilover by Engine Loading

In order to evaluate the engine loading effect on boilover, the test vehicles were divided into 5 different groups by grade horsepower. Grade horsepower is the horsepower required to climb a grade which is steep enough for the engine to show a 1° retard in timing advance. This horsepower is in addition to the 50 mph level road horsepower specified by the Federal Register. The number of test vehicles, number of boilovers and percentage of boilovers are plotted in Figure 9 and the numerical data are presented in Table 3-9.

Most of the vehicles tested were loaded on the light side of the curve. The vehicles operating at medium loads experienced the

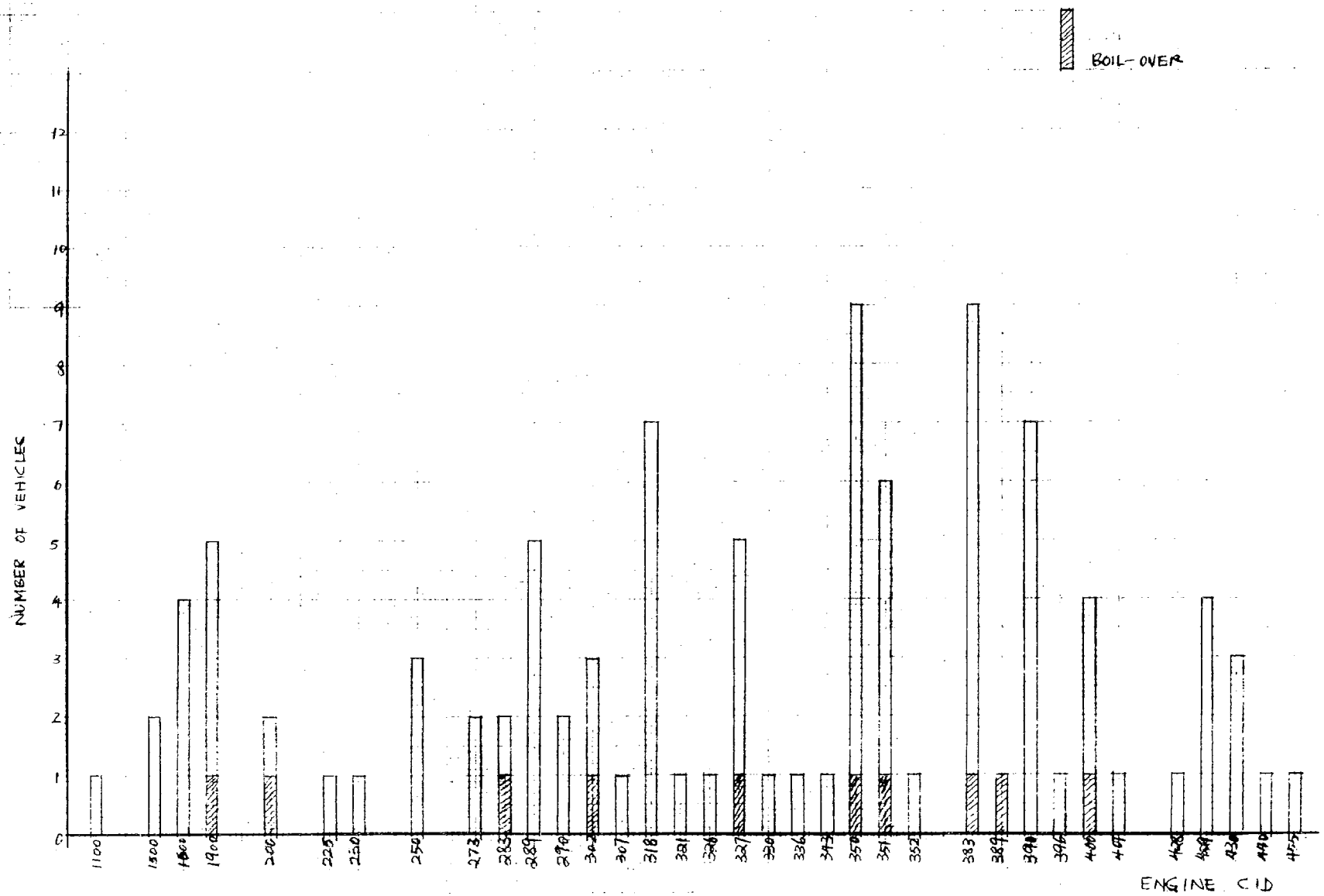


Figure 3-7. CONTROLLED VEHICLES STATISTICS BY ENGINE CID

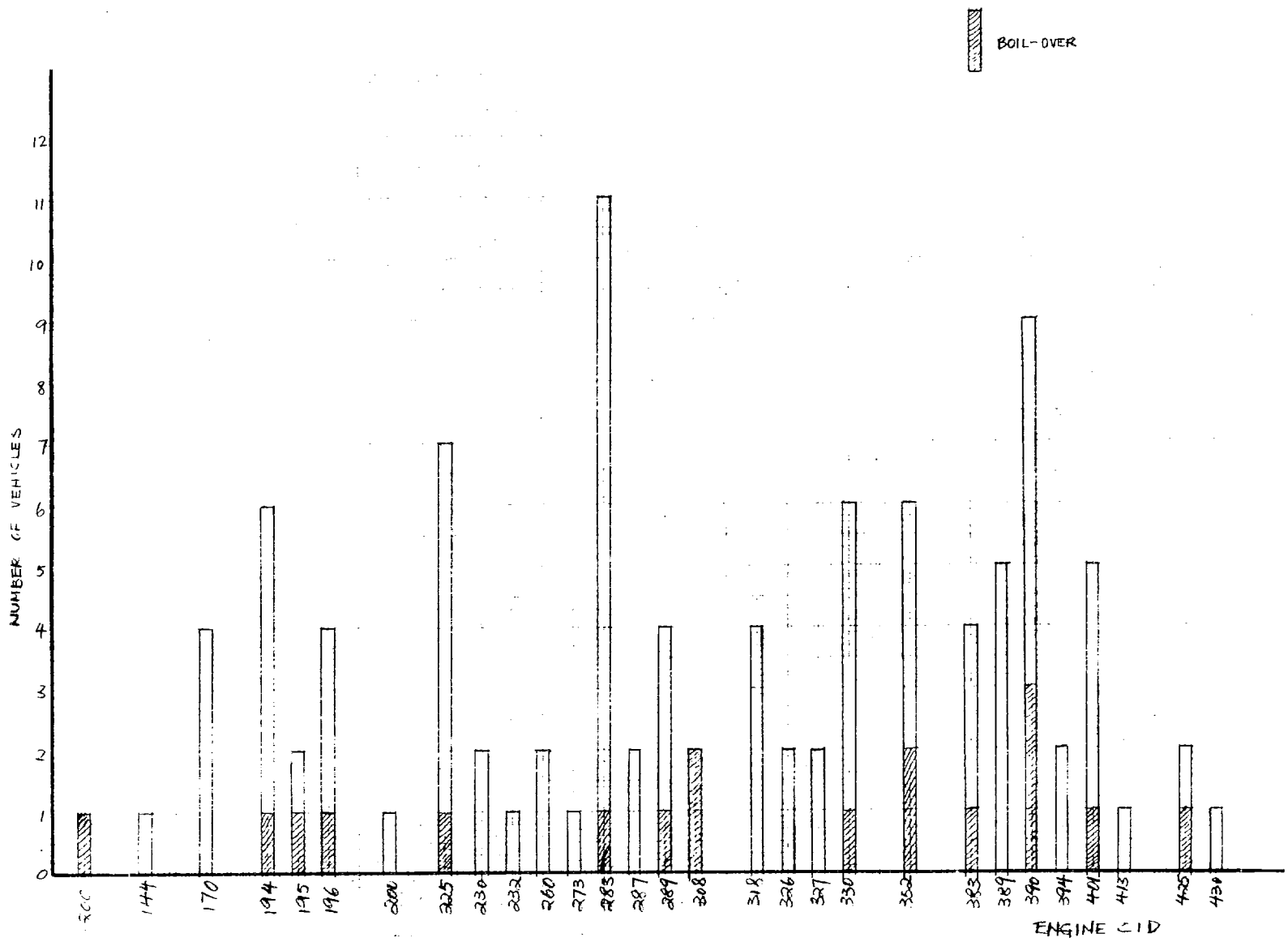


Figure 3-8. UNCONTROLLED VEHICLES STATISTICS BY ENGINE CID

Table 3-9. STATISTICAL DATA ON BOIL OVER BY ENGINE LOADING

GRADE HP	CONTROLLED VEHICLES			UNCONTROLLED VEHICLES		
	Sample Size	Boil Over	Percentage Boil Over	Sample Size	Boil Over	Percentage Boil Over
3.1- 8.0	27	2	6.4%	32	5	15.6%
8.1-13.0	31	5	16.0%	21	6	28.6%
13.1-18.0	13	1	7.7%	23	4	17.4%
18.1-23.0	25	2	8.0	6	1	16.7%
23.1-33.0	3	0	0	8	2	25.0%
Total	100	10	--	100	18	--

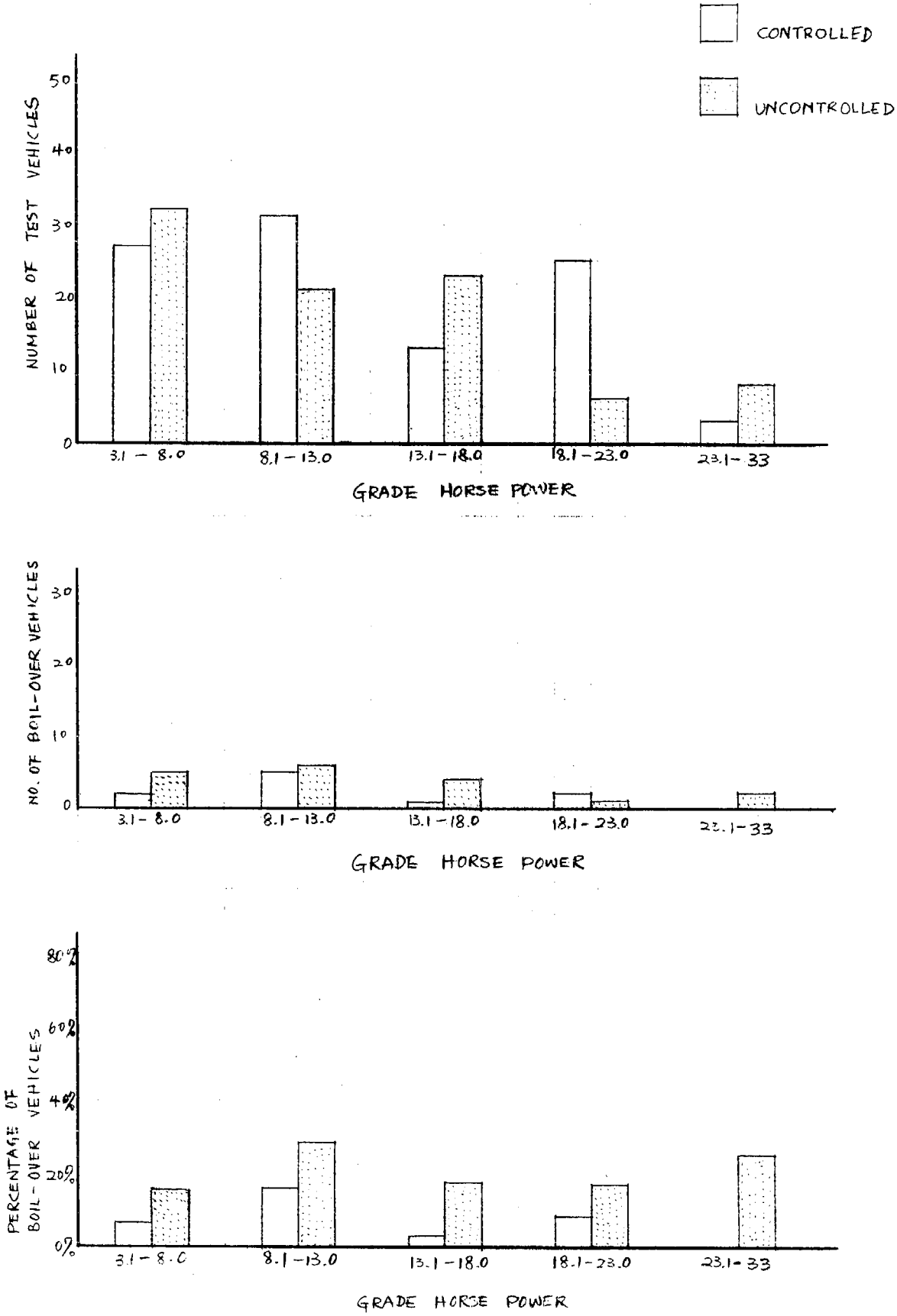


Figure 3-9. BOIL-OVER STATISTICS BY GRADE HORSEPOWER

least amount of boilover. The vehicles operating at light or extremely high load showed a higher percentage in boilover.

Two reasons may possibly explain this phenomenon of engine loading on boilover. The high load imposed on an engine would certainly stress and overload the engine, and cause the boilover. The light loadings may represent a group of vehicles which were in such a poor condition that they were already stressed to their maximum capacity at a slight load. This can be further evaluated when gross vehicle weight is imposed on grade horsepower and the statistics expressed in terms of road grade. The results are shown in Table 3-10 and plotted in Figure 3-10. Although the differences are not great, it is clear on uncontrolled vehicles that higher percentages of boilover occurred at the least and highest road grade.

3.3.2 Vehicle Temperature Statistics

Vehicle engine temperatures were measured at the following locations during the test.

(a) In front of the radiator for ambient air intake temperature.

(b) At the air cleaner inlet for carburetor air intake temperature.

(c) Radiator inlet for coolant water in temperature.

(d) Radiator outlet for coolant water out temperature.

(e) At end of oil dip stick for engine oil temperature.

(f) At the wall of heat-riser pipe for exhaust gas temperature.

(g) Inside of tailpipe for exhaust gas temperature.

Table 3-10. VEHICLE STATISTIC BY ROAD GRADE

GRADE (%)	CONTROLLED VEHICLES			UNCONTROLLED VEHICLES		
	Sample Size	Boil Over	Percentage Boil Over	Sample Size	Boil Over	Percentage Boil Over
Up to 0.99	14	1	7.1%	7	2	28.6%
1.00-1.49	12	1	8.3%	15	2	13.3%
1.50-1.99	17	1	5.9%	19	3	15.8%
2.00-2.49	11	1	9.0%	12	2	16.7%
2.50-2.99	11	2	18.0%	17	4	24.5%
3.00-3.49	14	2	14.3%	10	2	20.0%
3.50-3.99	1	0	0	7	0	0
4.00-4.49	11	2	18.1%	4	0	0
4.50 and Up	8	0	0	9	3	33.3%
Total	99	10	--	100	18	--

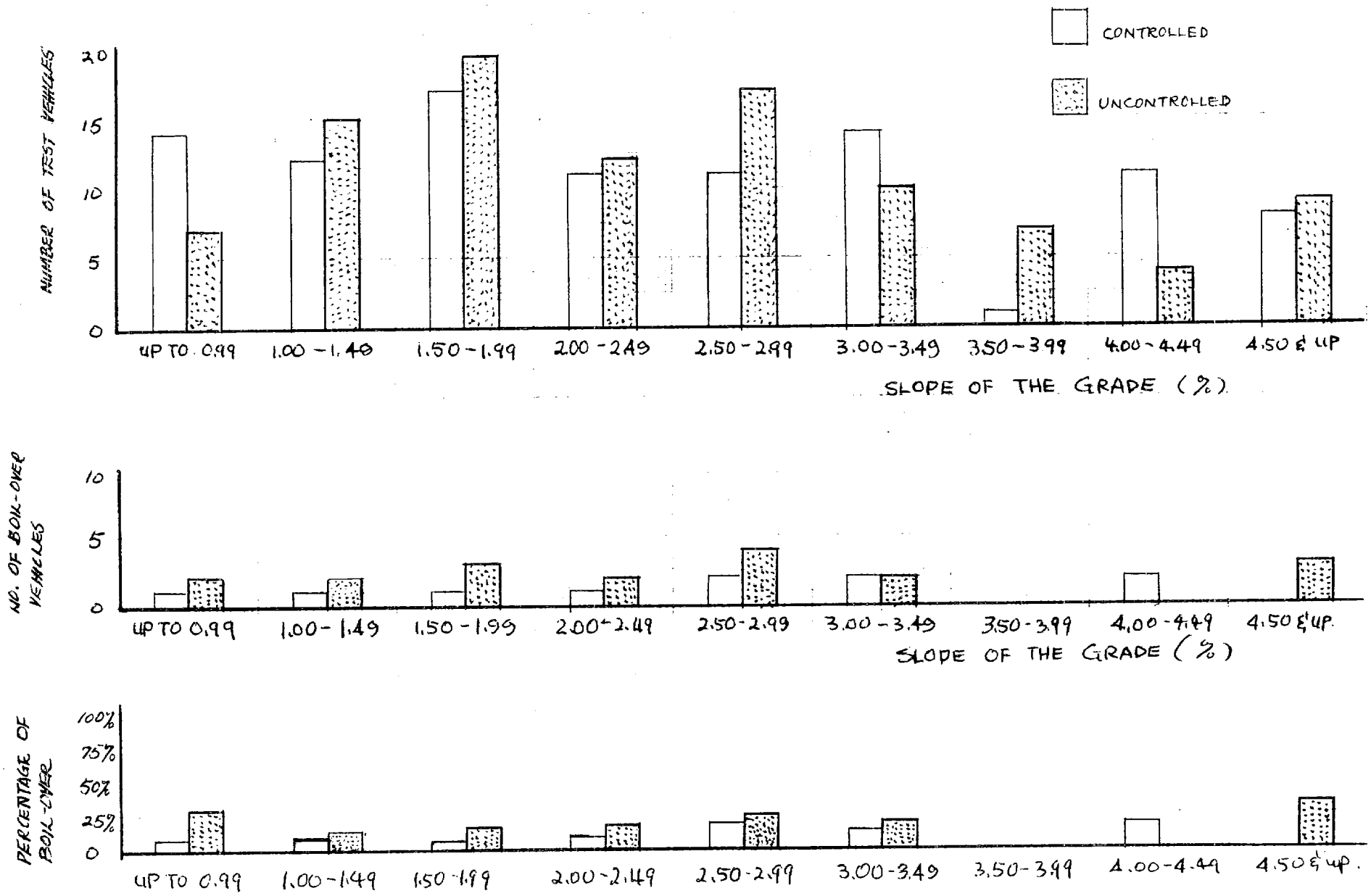


Figure 3-10. BOIL-OVER STATISTICS BY SLOPE OF THE GRADE

The temperatures which were believed to be most significant to the engine were compiled and summarized in the form of mean and standard deviation as shown in Table 3-11. The mean is the average of the recorded temperatures. The standard deviation is a measurement which indicates how the temperatures are spread out from the mean temperature. It is also known as a measure of dispersion. The measure will be large if the temperatures are distant from the mean temperature and small if they are close to the mean. The variance which is the square of standard deviation is defined as the sum of squares of the deviations of the temperatures from the mean temperature divided by one less than the total number of test vehicles. In mathematical symbols, let $\bar{X}$ be the mean temperature, let X_1, X_2, ..., X_n be the observed temperature, then $X_1 - \bar{X}$ is the deviation of the first observed temperature from the mean temperature, and so on (where N is the number of total observed temperatures).

The formula for standard deviation(s) is:

$$S = \left[\frac{\sum_{i=1}^{N} (x_i - \bar{x})^2}{N - 1} \right]^{1/2}$$ where S^2 is the variance.

The data are presented for controlled cars and uncontrolled cars. Baseline temperature is defined as the temperature when the vehicle was operated under normal conditions -- without vacuum advance disconnected. The temperature difference is defined as the difference between the test temperature with VAD and the baseline temperature. A negative number means that the temperature with VAD is lower than without VAD. The sample size varies with different measurements. There are reasons for the reduced sample size in this data summary.

(a) Vehicle boilover invalidates the significance of the temperature data since the test terminates immediately afterward to avoid damage to the vehicle.

(b) The exhaust temperature at heat riser pipe was not recorded at the beginning of the program.

(c) Termination of the test by reasons other than boilover; e.g., too high exhaust temperature which may damage the vehicle, etc.

(d) Data considered to be erroneous by statistical means.

From the summary of the temperature data presented in Table 3-11, the following conclusions are derived:

<u>For the controlled vehicle group</u>

- The average exhaust temperature increased approximately 10% under the loaded condition.

- The average exhaust temperature at the heat riser increased approximately 4% at idle condition whereas the exhaust temperature at the tailpipe increased almost 7%.

- Water temperature increased only slightly with vacuum advance disconnected especially during

Table 3-11. TEMPERATURE DATA SUMMARY ON TOTAL FLEET

THERMOCOUPLE LOCATIONS	TEST OPERATION TEMPERATURE		CONTROLLED CARS						UNCONTROLLED CARS					
			Baseline Temperature W/O VAD			Temperature Difference			Baseline Temperature W/O VAD			Temperature Difference		
			Mean	Std. Dev.	Sample Size	Mean	Std. Dev.	Sample Size	Mean	Std. Dev.	Sample Size	Mean	Std. Dev.	Sample Size
Exhaust Temperature at Heat Riser	Loaded	80°	750.87	101.63	79	74.45	47.01	76	702.61	105.17	85	58.11	39.25	81
		90°	747.33	99.62	78	74.75	37.51	75	695.88	104.34	81	54.38	40.17	76
		100°	747.25	101.81	76	76.51	35.75	70	693.52	110.22	77	56.58	36.98	72
	Idle	80°	533.15	64.27	79	18.66	26.35	79	452.09	68.15	81	23.99	31.84	81
		90°	533.17	65.75	77	22.08	27.86	76	455.08	66.71	79	26.57	39.13	77
		100°	542.53	71.03	74	16.71	27.40	69	453.29	71.61	73	26.49	26.28	70
Exhaust Temperature at Tailpipe	Loaded	80°	592.79	101.67	97	73.30	56.10	97	577.19	97.00	97	49.02	41.40	97
		90°	591.72	100.48	95	66.74	54.50	95	582.24	103.10	93	43.04	38.50	92
		100°	595.54	104.28	92	63.61	50.11	90	575.58	101.91	89	44.39	31.36	87
	Idle	80°	347.04	74.98	100	30.36	31.57	99	307.25	62.13	93	20.28	36.74	93
		90°	350.89	69.31	96	24.71	30.16	95	313.54	65.13	90	18.47	35.57	89
		100°	354.40	73.29	93	22.61	37.33	88	310.11	59.29	85	18.76	25.24	80
Coolant in Temperature	Loaded	80°	191.10	15.03	99	0.72	5.20	99	187.30	14.14	97	-2.45	6.07	97
		90°	195.47	16.00	97	0.63	8.63	97	193.09	12.63	93	-1.21	4.61	92
		100°	202.71	14.95	95	0.59	8.39	93	200.22	13.16	89	-1.56	4.91	87
	Idle	80°	210.24	16.71	99	1.62	5.23	98	207.24	13.28	93	0.96	6.10	93
		90°	215.78	16.55	96	1.19	6.02	95	214.16	13.32	91	1.74	5.41	89
		100°	222.71	17.43	93	0.64	4.90	88	220.19	12.55	86	1.10	5.18	80
Coolant out Temperature	Loaded	80°	179.41	15.95	100	0.18	5.47	100	175.26	14.33	97	-2.16	5.35	97
		90°	185.26	16.32	98	0.31	5.81	98	182.49	13.11	93	-1.05	4.12	92
		100°	193.58	15.42	96	0.69	8.72	94	190.43	13.46	89	-1.67	5.19	87
	Idle	80°	197.66	15.03	100	1.22	5.67	99	195.40	14.37	93	0.51	5.68	93
		90°	203.93	14.02	97	1.65	5.55	96	202.43	14.25	91	1.65	4.88	89
		100°	212.15	14.36	94	0.74	4.44	89	208.86	13.56	86	0.66	4.73	80
Oil Temperature	Loaded	80°	231.34	25.04	100	-1.59	6.36	100	235.69	20.87	97	-5.27	7.62	96
		90°	237.52	22.62	98	-2.04	5.74	98	240.90	19.48	93	-3.08	4.42	92
		100°	243.99	21.09	96	-1.87	6.01	94	246.43	18.55	88	-4.02	4.92	86
	Idle	80°	227.06	17.51	100	-0.82	5.86	99	224.92	16.52	93	-4.08	6.70	93
		90°	231.87	16.86	97	-0.15	7.04	96	231.34	16.48	90	-2.02	4.58	88
		100°	238.23	15.32	94	-1.14	4.42	90	236.87	15.21	85	-2.38	4.71	80

the idle condition. In general, it is concluded that coolant temperature did not show much variation.

- Oil temperature decreased slightly with vacuum advance disconnected.

- Monitored temperatures generally increased as the ambient temperature increased.

For uncontrolled vehicle group

- The average exhaust temperature under loaded conditions increased approximately 8% at both the heat riser and tailpipe.

- The average exhaust temperature at idle condition increased approximately 6% at both the heat riser and tailpipe.

- The average coolant temperature decreased slightly during loaded condition and showed little variation during idling.

- Oil temperature decreased both under loaded and idle conditions with the vacuum advance disconnected.

- Monitored temperatures generally increased as the ambient temperature increased.

3.3.2.1 Vehicle Temperature by Engine Class

The same format of vehicle temperature summary was repeated for the six (6) different engine classes in order to determine whether there was any difference between engine classes. The results are presented in Table 3-12 through Table 3-17. It is observed that most of the temperatures varied slightly from each other and no significant difference should be concluded except for the following discussions where the data showed some degree of difference in the mean temperature or standard deviations from the total fleet. The general comparison was made in two groups, controlled and uncontrolled vehicles.

(a) Controlled Vehicles

- The class A group vehicles had the lowest baseline temperature without VAD. All the engine mean temperatures of class A in baseline tests without VAD were smaller than the total fleet mean temperatures except the exhaust temperature at 100° F idling.

- In class B group of vehicles, the exhaust baseline without VAD mean temperatures at heat riser during loaded condition were much greater than the mean temperatures on the total fleet. Also, the mean and standard deviations of the temperature difference deviated greatly from the total fleet. Since there were only four vehicles in this group, this sample size is too small

Table 3-12. TEMPERATURE DATA SUMMARY ON CLASS A VEHICLES (UNDER 200 CID)

THERMOCOUPLE LOCATIONS	TEST OPERATION TEMPERATURE		CONTROLLED CARS						UNCONTROLLED CARS					
			Baseline Temperature W/O VAD			Temperature Difference			Baseline Temperature W/O VAD			Temperature Difference		
			Mean	Std. Dev.	Sample Size	Mean	Std. Dev.	Sample Size	Mean	Std. Dev.	Sample Size	Mean	Std. Dev.	Sample Size
Exhaust Temperature at Heat Riser	Loaded	80°	704.44	110.30	9	79.13	83.37	8	730.93	130.58	15	60.38	55.92	13
		90°	710.44	114.66	9	72.88	56.70	8	724.67	128.19	15	47.67	48.08	12
		100°	713.13	124.82	8	70.43	57.27	7	727.47	132.90	15	46.75	35.98	12
	Idle	80°	512.56	77.78	9	13.11	20.95	9	459.00	58.58	15	25.53	25.86	15
		90°	526.78	77.34	9	10.78	20.78	9	469.40	57.43	15	21.86	28.79	14
		100°	557.50	90.53	8	-1.50	21.98	8	467.50	58.52	14	18.42	26.63	12
Exhaust Temperature at Tailpipe	Loaded	80°	565.00	79.37	10	78.00	78.08	10	629.69	113.55	16	65.44	62.02	16
		90°	564.30	86.08	10	56.90	65.75	10	633.63	120.54	16	52.53	60.20	15
		100°	557.22	79.80	9	58.11	61.86	9	626.88	122.20	16	41.29	41.65	14
	Idle	80°	294.58	58.63	12	34.42	39.33	12	290.69	62.14	16	26.25	28.75	16
		90°	307.92	46.41	12	18.50	25.09	12	309.44	54.23	16	4.33	32.68	15
		100°	309.54	63.29	11	25.36	35.04	11	301.20	50.70	15	20.33	27.94	12
Coolant in Temperature	Loaded	80°	170.36	22.25	11	-0.18	4.29	11	189.44	15.93	16	-1.00	6.13	16
		90°	175.64	19.84	11	-0.64	4.67	11	197.25	13.37	16	-2.20	6.04	15
		100°	182.40	21.67	10	-1.40	3.72	10	203.94	12.86	16	-0.93	7.04	14
	Idle	80°	183.64	25.75	11	-0.55	4.63	11	205.38	16.03	16	1.38	6.23	16
		90°	189.36	25.71	11	0.91	4.44	11	211.63	14.84	16	1.33	5.30	15
		100°	195.00	29.16	10	0.50	4.01	10	218.50	14.02	16	0.33	5.33	12
Coolant out Temperature	Loaded	80°	175.83	27.36	12	-2.08	6.04	12	174.00	14.09	16	-1.81	6.52	16
		90°	181.50	29.01	12	0.17	5.98	12	182.50	13.67	16	-1.67	4.75	15
		100°	190.82	30.81	11	0.00	5.44	11	190.44	13.17	16	-1.93	8.26	14
	Idle	80°	191.50	20.76	12	0.92	5.02	12	190.56	15.35	16	1.94	6.31	16
		90°	196.08	21.17	12	3.00	4.59	12	197.31	14.95	16	2.53	5.15	15
		100°	204.64	23.81	11	1.91	5.01	11	204.94	13.84	16	-0.08	5.09	12
Oil Temperature	Loaded	80°	198.83	31.33	12	0.83	6.77	12	218.88	24.25	16	-4.00	6.06	16
		90°	213.50	26.94	12	-0.92	3.65	12	225.81	21.45	16	-1.00	4.47	15
		100°	223.91	26.95	11	-2.18	4.79	11	233.44	21.48	16	-2.79	5.75	14
	Idle	80°	204.75	14.76	12	-0.40	4.10	12	214.88	18.56	16	-1.75	6.82	16
		90°	211.67	14.97	12	0.33	3.85	12	221.25	16.06	16	-0.53	3.64	15
		100°	221.00	13.76	11	-1.45	5.13	11	228.94	15.93	16	-2.31	5.53	13

Table 3-13. TEMPERATURE DATA SUMMARY ON CLASS B VEHICLES (200-249 CID)

THERMOCOUPLE LOCATIONS	TEST OPERATION TEMPERATURE		CONTROLLED CARS						UNCONTROLLED CARS					
			Baseline Temperature W/O VAD			Temperature Difference			Baseline Temperature W/O VAD			Temperature Difference		
			Mean	Std. Dev.	Sample Size	Mean	Std. Dev.	Sample Size	Mean	Std. Dev.	Sample Size	Mean	Std. Dev.	Sample Size
Exhaust Temperature at Heat Riser	Loaded	80°	923.33	63.61	3	33.50	36.06	2	796.56	126.33	9	41.29	58.83	7
		90°	917.00	57.47	3	67.50	23.33	2	776.11	117.19	9	41.71	48.24	7
		100°	915.33	62.12	3	46.00	38.18	2	781.77	121.77	9	46.57	55.10	7
	Idle	80°	579.00	101.60	3	35.67	42.03	3	509.22	111.88	9	50.33	63.16	9
		90°	605.00	127.08	3	39.67	62.66	3	518.56	102.34	9	25.67	35.69	9
		100°	627.00	150.05	3	-2.50	10.61	2	524.78	94.33	9	10.75	13.20	8
Exhaust Temperature at Tailpipe	Loaded	80°	573.75	174.01	4	122.75	156.17	4	560.64	117.86	11	40.00	51.70	11
		90°	558.25	163.44	4	123.00	149.88	4	579.36	134.87	11	39.73	36.02	11
		100°	571.50	163.38	4	99.75	148.85	4	584.45	119.90	11	44.18	42.87	11
	Idle	80°	301.75	57.73	4	27.00	58.95	4	303.64	84.01	11	44.91	66.82	11
		90°	303.25	51.60	4	39.25	66.27	4	317.45	67.67	11	26.91	43.95	11
		100°	317.00	56.59	4	7.33	11.02	3	316.91	73.70	11	14.00	37.19	10
Coolant in Temperature	Loaded	80°	193.25	6.50	4	4.50	13.96	4	186.45	9.47	11	-2.00	3.95	11
		90°	199.50	6.35	4	8.50	17.82	4	192.36	10.62	11	-0.27	5.06	11
		100°	207.00	2.45	4	5.00	13.64	4	202.27	12.88	11	-1.27	4.96	11
	Idle	80°	219.75	3.69	4	7.25	12.69	4	207.36	13.24	11	-0.91	5.07	11
		90°	225.50	2.89	4	6.50	16.30	4	212.55	12.87	11	0.00	5.20	11
		100°	234.25	7.14	4	-0.33	3.06	3	221.27	13.45	11	-0.40	6.62	10
Coolant out Temperature	Loaded	80°	193.25	17.11	4	-4.00	6.16	4	171.91	14.31	11	-1.64	3.98	11
		90°	191.50	7.19	4	4.00	14.49	4	178.82	16.95	11	-0.73	5.53	11
		100°	199.25	3.86	4	4.75	12.42	4	189.27	18.26	11	-1.91	4.93	11
	Idle	80°	209.25	4.72	4	6.75	12.45	4	192.09	16.10	11	-0.64	4.65	11
		90°	214.00	6.22	4	8.25	13.57	4	198.00	15.59	11	-0.09	4.74	11
		100°	223.25	7.76	4	0.00	5.00	3	207.09	17.55	11	0.10	6.85	10
Oil Temperature	Loaded	80°	224.75	16.13	4	-0.75	5.91	4	215.27	16.33	11	-4.36	4.27	11
		90°	227.75	23.61	4	4.75	9.07	4	223.00	15.50	11	-4.09	5.56	11
		100°	234.25	23.98	4	7.25	16.56	4	231.73	13.45	11	-3.00	4.98	11
	Idle	80°	222.50	15.26	4	2.75	7.46	4	197.45	62.45	11	-2.55	5.43	11
		90°	227.75	19.81	4	8.50	11.47	4	217.73	14.58	11	-2.64	6.77	11
		100°	237.00	15.34	4	2.33	6.03	3	226.82	12.94	11	-2.40	5.48	10

Table 3-14. TEMPERATURE DATA SUMMARY ON CLASS C VEHICLES (250-299 CID)

THERMOCOUPLE LOCATIONS	TEST OPERATION TEMPERATURE		CONTROLLED CARS						UNCONTROLLED CARS					
			Baseline Temperature W/O VAD			Temperature Difference			Baseline Temperature W/O VAD			Temperature Difference		
			Mean	Std. Dev.	Sample Size	Mean	Std. Dev.	Sample Size	Mean	Std. Dev.	Sample Size	Mean	Std. Dev.	Sample Size
Exhaust Temperature at Heat Riser	Loaded	80°	745.30	87.16	10	90.90	65.89	10	670.78	67.86	18	62.61	32.81	18
		90°	737.80	85.84	10	91.40	53.53	10	668.89	65.92	17	51.88	31.64	17
		100°	741.56	82.20	9	76.89	56.43	9	665.88	71.10	16	48.94	37.42	16
	Idle	80°	523.40	70.52	10	19.40	42.17	10	427.76	37.94	17	19.41	18.02	17
		90°	527.00	66.57	10	29.44	47.00	9	427.24	30.45	17	25.88	24.99	16
		100°	558.33	56.60	9	20.78	18.53	9	426.19	32.95	16	27.38	16.02	16
Exhaust Temperature at Tailpipe	Loaded	80°	633.43	90.72	14	79.86	49.75	14	584.30	81.17	20	52.95	30.39	20
		90°	635.29	82.13	14	72.14	49.16	14	594.11	83.59	19	40.37	30.03	19
		100°	642.46	86.49	13	64.08	43.96	13	599.67	69.00	18	39.50	28.10	18
	Idle	80°	374.14	83.09	14	28.86	38.56	14	330.37	48.42	19	19.00	22.75	19
		90°	381.79	87.31	14	26.62	24.89	13	328.84	47.35	19	24.11	27.08	18
		100°	384.38	73.55	13	19.23	32.38	13	334.28	55.17	18	25.22	22.05	18
Coolant in Temperature	Loaded	80°	185.14	13.62	14	2.93	5.14	14	185.75	15.71	20	-3.40	6.04	20
		90°	192.93	12.65	14	0.21	6.73	14	191.00	12.78	19	-1.79	5.43	19
		100°	201.92	12.28	13	-2.62	5.45	13	197.67	10.09	18	-2.50	4.96	18
	Idle	80°	210.57	14.65	14	1.43	4.67	14	205.11	12.91	19	-0.05	5.34	19
		90°	216.57	13.36	14	2.46	6.16	13	212.37	12.90	19	2.06	5.27	18
		100°	222.85	13.69	13	0.54	7.33	13	218.56	13.58	18	1.22	4.67	18
Coolant out Temperature	Loaded	80°	174.36	17.20	14	1.79	4.95	14	175.70	15.75	20	-2.35	6.03	20
		90°	181.86	13.89	14	1.50	7.20	14	181.79	11.36	19	-1.00	3.59	19
		100°	191.85	11.07	13	-2.54	4.86	13	189.89	11.52	18	-2.72	5.68	18
	Idle	80°	200.36	15.01	14	0.43	5.35	14	192.84	12.37	19	-0.26	5.63	19
		90°	205.43	13.65	14	2.23	5.60	13	200.68	11.91	19	1.67	4.70	18
		100°	211.38	12.15	13	0.92	6.93	13	207.33	11.85	18	0.39	3.90	18
Oil Temperature	Loaded	80°	226.79	17.96	14	-3.29	5.99	14	236.85	17.96	20	-4.10	8.69	20
		90°	231.86	15.23	14	-1.71	5.53	14	242.42	16.55	19	-3.74	4.23	19
		100°	239.77	11.40	13	-3.69	5.42	13	247.88	16.85	17	-6.24	5.77	17
	Idle	80°	222.14	15.00	14	-0.79	4.98	14	223.42	13.55	19	-2.84	5.38	19
		90°	227.57	12.59	14	-0.08	6.34	13	232.89	15.60	18	-2.12	5.31	17
		100°	234.46	11.02	13	-2.33	5.09	13	237.88	13.99	17	-2.76	5.30	17

Table 3-15. TEMPERATURE DATA ON CLASS D VEHICLES (300-349 CID)

THERMOCOUPLE LOCATIONS	TEST OPERATION TEMPERATURE		CONTROLLED CARS						UNCONTROLLED CARS					
			Baseline Temperature W/O VAD			Temperature Difference			Baseline Temperature W/O VAD			Temperature Difference		
			Mean	Std. Dev.	Sample Size	Mean	Std. Dev.	Sample Size	Mean	Std. Dev.	Sample Size	Mean	Std. Dev.	Sample Size
Exhaust Temperature at Heat Riser	Loaded	80°	770.24	101.56	17	83.71	46.64	17	642.54	109.20	13	61.38	33.70	13
		90°	774.50	106.83	16	78.31	35.44	16	629.58	115.01	12	65.33	31.10	12
		100°	778.25	102.50	16	79.53	37.71	15	630.83	110.22	12	71.17	40.03	12
	Idle	80°	559.47	49.63	17	18.53	30.01	17	411.92	67.36	12	26.75	26.48	12
		90°	559.50	54.41	16	23.13	33.73	16	411.08	62.87	12	27.08	15.37	12
		100°	558.63	66.09	16	22.21	39.42	14	422.09	71.12	11	33.64	20.01	11
Exhaust Temperature at Tailpipe	Loaded	80°	595.10	104.29	21	77.24	47.23	21	552.38	71.73	16	45.44	30.60	16
		90°	611.20	103.94	20	57.15	41.71	20	516.13	142.55	15	46.07	21.84	15
		100°	612.05	106.66	20	61.42	40.92	19	543.47	63.53	15	53.13	28.58	15
	Idle	80°	361.43	71.71	21	35.67	32.70	21	290.53	53.56	15	14.07	21.80	15
		90°	375.85	61.89	20	24.00	33.95	20	294.40	82.15	15	22.13	37.62	15
		100°	376.95	68.37	20	25.83	26.67	18	303.50	54.85	14	24.69	21.31	13
Coolant in Temperature	Loaded	80°	193.62	7.97	21	0.10	5.26	21	190.38	17.06	16	-2.88	6.08	16
		90°	198.10	8.40	20	0.15	5.35	20	194.40	16.19	15	-1.33	2.26	15
		100°	205.30	9.60	20	4.05	14.58	19	201.47	17.22	15	-2.07	2.31	15
	Idle	80°	212.10	8.89	21	0.71	4.79	21	205.73	12.61	15	3.27	5.19	15
		90°	218.95	7.16	20	-0.10	4.99	20	212.73	14.01	15	3.67	4.22	15
		100°	226.60	8.54	20	-0.56	4.06	18	218.21	13.69	14	2.46	3.99	13
Coolant out Temperature	Loaded	80°	180.71	9.66	21	0.71	5.25	21	179.56	14.09	16	-2.94	5.96	16
		90°	187.55	8.67	20	-0.30	5.25	20	185.00	12.62	15	-1.00	2.33	15
		100°	195.30	10.04	20	3.42	14.06	19	192.33	13.05	15	-0.93	1.98	15
	Idle	80°	199.14	7.87	21	-0.38	3.84	21	195.53	12.86	15	2.20	4.72	15
		90°	206.55	7.78	20	0.60	4.10	20	202.27	13.27	15	3.13	3.81	15
		100°	214.80	9.08	20	0.39	3.90	18	208.00	11.58	14	1.62	3.75	13
Oil Temperature	Loaded	80°	231.57	17.70	21	-0.10	4.16	21	238.56	13.97	16	-4.38	9.05	16
		90°	240.05	17.52	20	-3.65	6.55	20	242.80	13.00	15	-2.67	2.92	15
		100°	246.15	18.14	20	-1.68	6.29	19	248.80	11.87	15	-2.80	4.43	15
	Idle	80°	227.76	10.68	21	0.19	4.76	21	229.07	10.15	15	-5.00	6.11	15
		90°	234.15	9.96	20	-1.75	5.44	20	238.53	14.38	15	-2.27	2.84	15
		100°	240.30	11.38	20	-1.06	4.15	18	242.36	11.72	14	-2.54	2.76	13

Table 3-16. TEMPERATURE DATA ON CLASS E VEHICLES (350-399 CID)

THERMOCOUPLE LOCATIONS	TEST OPERATION TEMPERATURE		CONTROLLED CARS						UNCONTROLLED CARS					
			Baseline Temperature W/O VAD			Temperature Difference			Baseline Temperature W/O VAD			Temperature Difference		
			Mean	Std. Dev.	Sample Size	Mean	Std. Dev.	Sample Size	Mean	Std. Dev.	Sample Size	Mean	Std. Dev.	Sample Size
Exhaust Temperature at Heat Riser	Loaded	80°	746.52	94.37	27	78.08	38.47	26	697.68	82.44	25	58.92	32.73	25
		90°	741.78	89.12	27	73.31	36.35	26	668.04	147.25	24	56.08	42.34	24
		100°	733.37	101.19	27	81.40	29.64	25	652.67	154.23	21	59.24	28.70	21
	Idle	80°	534.74	63.79	27	20.81	23.49	27	455.91	52.44	23	17.30	27.72	23
		90°	524.54	61.35	26	23.88	18.72	26	457.33	54.31	21	28.90	61.77	21
		100°	526.42	61.27	26	17.54	24.73	24	438.28	63.09	18	38.33	37.44	18
Exhaust Temperature at Tailpipe	Loaded	80°	609.36	88.05	33	72.88	42.87	33	556.96	88.63	26	47.92	36.89	26
		90°	601.41	86.80	32	73.66	45.30	32	552.04	91.02	25	40.16	39.55	25
		100°	604.50	90.35	32	70.59	40.16	32	528.50	93.93	22	46.91	25.22	22
	Idle	80°	352.44	53.31	34	28.82	26.37	33	301.36	64.46	25	12.96	38.48	25
		90°	354.09	53.66	32	26.38	30.99	32	299.35	69.12	23	18.48	38.78	23
		100°	361.22	63.74	32	21.70	49.86	30	281.35	53.48	20	13.80	25.53	20
Coolant in Temperature	Loaded	80°	194.50	11.27	34	0.65	3.61	34	184.58	10.03	26	-1.85	6.08	26
		90°	197.27	16.23	33	0.82	11.74	33	191.72	10.79	25	-0.60	4.09	25
		100°	203.91	11.98	33	0.15	5.53	33	197.64	13.23	22	-0.95	4.97	22
	Idle	80°	214.44	11.79	34	2.85	4.12	33	209.04	12.41	25	1.64	6.93	25
		90°	219.34	11.57	32	1.22	5.69	32	216.30	12.35	23	1.83	6.78	23
		100°	226.03	11.70	32	1.17	4.58	30	220.35	10.32	20	1.45	6.00	20
Coolant out Temperature	Loaded	80°	179.35	11.19	34	1.00	4.71	34	173.54	13.41	26	-1.88	5.09	26
		90°	184.61	15.60	33	1.76	11.14	33	183.20	13.36	25	-0.80	4.63	25
		100°	192.79	13.37	33	0.06	7.06	33	189.82	14.14	22	-0.95	4.65	22
	Idle	80°	198.09	12.71	34	2.18	4.24	33	198.96	14.40	25	-0.04	6.70	25
		90°	204.13	12.14	32	1.53	5.30	32	206.00	14.29	23	1.17	5.90	23
		100°	212.47	12.57	32	0.70	3.44	30	210.95	13.42	20	0.90	5.25	20
Oil Temperature	Loaded	80°	239.76	20.53	34	-2.68	7.29	34	246.12	13.85	26	-6.64	7.47	25
		90°	243.42	19.16	33	-1.70	5.42	33	252.44	15.86	25	-3.76	4.85	25
		100°	248.30	18.31	33	-1.94	4.58	33	255.77	16.25	22	-4.41	3.87	22
	Idle	80°	233.12	16.16	34	-1.18	5.94	33	233.44	13.95	25	-6.28	7.66	25
		90°	237.97	15.15	32	-1.38	5.79	32	237.39	15.56	23	-1.96	4.73	23
		100°	242.00	14.45	32	-1.47	4.24	30	239.90	15.36	20	-1.75	4.90	20

Table 3-17. TEMPERATURE DATA ON CLASS F VEHICLES (400 AND UP CID)

THERMOCOUPLE LOCATIONS	TEST OPERATION TEMPERATURE		CONTROLLED CARS						UNCONTROLLED CARS					
			Baseline Temperature W/O VAD			Temperature Difference			Baseline Temperature W/O VAD			Temperature Difference		
			Mean	Std. Dev.	Sample Size	Mean	Std. Dev.	Sample Size	Mean	Std. Dev.	Sample Size	Mean	Std. Dev.	Sample Size
Exhaust Temperature at Heat Riser	Loaded	80°	753.08	94.02	13	54.77	42.48	13	736.67	52.88	6	40.17	35.07	6
		90°	729.08	81.95	13	77.54	34.59	13	726.40	58.85	5	60.20	51.69	5
		100°	733.08	68.38	13	85.50	35.15	12	716.40	65.69	5	53.60	42.41	5
	Idle	80°	518.15	53.89	13	29.85	32.26	13	458.00	21.20	5	9.00	18.40	5
		90°	520.92	55.56	13	18.38	14.72	13	455.00	29.53	5	21.80	35.61	5
		100°	527.17	54.29	12	17.50	18.72	12	455.00	30.10	5	13.60	9.45	5
Exhaust Temperature at Tailpipe	Loaded	80°	556.47	113.04	15	65.20	55.92	15	592.50	120.57	8	35.13	27.37	8
		90°	550.40	112.38	15	57.07	48.09	15	616.57	133.46	7	30.43	34.34	7
		100°	559.86	121.91	14	46.23	37.51	13	599.29	130.31	7	36.57	23.14	7
	Idle	80°	329.53	69.78	15	27.93	19.80	15	344.86	49.89	7	10.86	31.05	7
		90°	337.21	78.01	14	24.93	19.28	14	353.14	66.28	7	13.14	34.02	7
		100°	333.00	84.25	13	27.46	30.75	13	351.71	55.24	7	9.43	10.05	7
Coolant in Temperature	Loaded	80°	200.07	12.55	15	0.67	5.23	15	193.75	20.58	8	-6.13	8.82	8
		90°	203.87	14.34	15	0.07	3.37	15	196.14	17.76	7	-1.00	4.43	7
		100°	209.13	16.00	15	0.07	3.34	14	202.29	14.47	7	-1.14	5.61	7
	Idle	80°	214.47	13.66	15	0.73	5.70	15	212.43	11.62	7	-2.86	7.80	7
		90°	220.00	14.67	15	0.53	4.67	15	222.14	11.33	7	-0.14	3.18	7
		100°	225.93	15.79	14	1.29	5.20	14	227.00	9.18	7	1.00	4.83	7
Coolant out Temperature	Loaded	80°	182.00	19.81	15	-0.73	7.13	15	180.88	17.84	8	-3.88	5.57	8
		90°	187.73	17.17	15	-0.07	3.45	15	185.43	15.95	7	-1.57	3.82	7
		100°	195.20	15.89	15	0.93	6.32	14	193.14	14.09	7	-1.14	5.01	7
	Idle	80°	195.80	21.03	15	1.27	8.44	15	202.86	11.13	7	-1.86	4.81	7
		90°	203.67	16.77	15	0.60	4.93	15	211.86	10.85	7	0.43	2.82	7
		100°	213.00	15.80	14	0.71	4.61	14	215.86	9.34	7	2.14	5.01	7
Oil Temperature	Loaded	80°	245.47	21.33	15	-1.93	6.71	15	254.13	14.19	8	-8.63	8.23	8
		90°	250.20	21.77	15	-4.00	4.97	15	255.57	8.66	7	-2.14	3.85	7
		100°	253.27	20.46	15	-2.64	3.59	14	261.57	8.89	7	-3.71	4.89	7
	Idle	80°	237.13	15.59	15	-0.93	6.00	15	236.71	8.67	7	-5.29	8.24	7
		90°	238.07	18.32	15	2.40	10.76	15	244.57	11.04	7	-3.00	4.08	7
		100°	245.71	15.11	14	-1.57	2.56	14	249.00	11.60	7	-2.14	5.21	7

compared with the sample sizes of the total fleet and the other engine CID classes. Therefore, no significant conclusion can be drawn from the data of mean temperatures and standard deviations of the class B vehicles.

- In the class E group of vehicles, the standard deviations of the baseline temperature without VAD were generally smaller than those in the total fleet. That is, the observed temperatures in this engine CID group were scattered closer to the mean temperature than the total fleet.

(b) Uncontrolled Vehicles

- In class B group of vehicles, the exhaust baseline mean temperature without VAD at heat riser was higher than the total fleet while the baseline coolant temperatures were less than the total fleet mean temperatures.

- In class D group of vehicles, the engine size between 300 - 349 CID group, the exhaust baseline mean temperatures without VAD at the heat riser and at tailpipe were less than the total fleet.

- In class F group of the vehicles, the baseline mean temperatures were greater than

for the total fleet as well as for class C, D and E vehicles.

3.4 CONCLUSIONS

The general conclusions drawn from this study program are:

- VAD affected 70% of the boilovers among controlled vehicles.
- VAD affected 33.3% of the boilovers among the uncontrolled vehicles.
- VAD affected extreme exhaust temperatures on one vehicle.
- VAD affected extreme oil temperature on two vehicles.
- VAD in general would increase the exhaust temperature.
- VAD in general would slightly decrease the coolant temperature and oil temperature.
- When the vacuum advance is disconnected on an engine not designed for that feature, less heat is rejected in the cooling system and more heat is rejected in the exhaust system.

SECTION 4

REFERENCES

1. Mandatory vehicle emission inspection and maintenance, final report. Prepared under Contract ARB 1522 with State of California Air Resources Board by Northrop Corporation in association with Olson Laboratories, Inc., December 1971.

2. E. F. Obert, "Internal Combustion Engines Analysis and Practice", International Textbook Company, Scranton, Pennsylvania.

3. R. M. Siewert, "How Individual Valve Timing Events Affect Exhaust Emissions", Research Laboratories, General Motor Corporation, SAE Paper #71069, presented at SAE Mid-Year Meeting, Montreal, June 1971.

4. E. J. Martin and D. R. Vance, "Exhaust Recirculation and Spark Control - A Speed Governed and Vacuum Modulated System", Perfect Circle Division, Dana Corporation, SAE Paper #720123, presented at SAE Automotive Engineering Congress, Detroit, Michigan, January 1972.

5. P. H. Schweitzer, "Control of Exhaust Pollution Through a Mixture-Optimizer", Optimizer Control Corporation, SAE Paper #720254 presented at SAE Automotive Engineering Congress, Detroit, Michigan, January 1972.

6. "Effect of Echlin Device on Exhaust Gas Temperature", Project M-240, California Air Resources Board, August 1972.

APPENDIX A

DYNAMOMETER CALIBRATION

OLSON LABORATORIES, INC.

TESTING SERVICES DIVISION

DYNAMOMETER CALIBRATION DATA

DEPT NO.	SHIFT	TRAIN	DATE	P.I.C.
0352	1	VAD	7-25-72	AV/LB/REP

FORMULA: HPd = 0.06073 (Wi/t)

HPd = ABSORBED ROAD HORSEPOWER
0.06073 = CONSTANT
Wi = EQUIVALENT INERTIA
t = ROLL DOWN TIME (SEC.)

IHP			AHP
(1)	0.06073 (4000/ 67.5	t_1) = 3.6	
	0.06073 (4000/ 67.5	t_2) = 3.6	
	0.06073 (4000/ 67.5	t_3) = 3.6	
	0.06073 (4000/	t_4) =	
			3.6 = AVE. AHP
5	0.06073 (4000/ 29.6	t_1) = 8.2	
	0.06073 (4000/ 30	t_2) = 8.1	
	0.06073 (4000/ 29.3	t_3) = 8.3	
	0.06073 (4000/	t_4) =	
			8.2 = AVE. AHP
10	0.06073 (4000/ 17.7	t_1) = 13.6	
	0.06073 (4000/ 17.7	t_2) = 13.6	
	0.06073 (4000/ 18	t_3) = 13.5	
	0.06073 (4000/	t_4) =	
			13.6 = AVE. AHP
15	0.06073 (4000/ 13	t_1) = 18.7	
	0.06073 (4000/ 12.9	t_2) = 18.8	
	0.06073 (4000/ 12.8	t_3) = 19	
	0.06073 (4000/	t_4) =	
			18.8 = AVE. AHP
20	0.06073 (4000/ 10	t_1) = 24.2	
	0.06073 (4000/ 9.9	t_2) = 24.5	
	0.06073 (4000/ 9.8	t_3) = 24.8	
	0.06073 (4000/	t_4) =	
			24.5 = AVE. AHP
25	0.06073 (4000/ 8.2	t_1) = 29.7	
	0.06073 (4000/ 8.1	t_2) = 30.0	
	0.06073 (4000/	t_3) = 29.2	
	0.06073 (4000/	t_4) =	
			29.6 = AVE. AHP
30	0.06073 (4000/ 6.8	t_1) = 35.5	
	0.06073 (4000/ 6.9	t_2) = 35.0	
	0.06073 (4000/ 7.0	t_3) = 34.6	
	0.06073 (4000/	t_4) =	
			35.0 = AVE. AHP

OLSON LABORATORIES, INC.
A Subsidiary of Northrop Corporation

TESTING SERVICES DIVISION

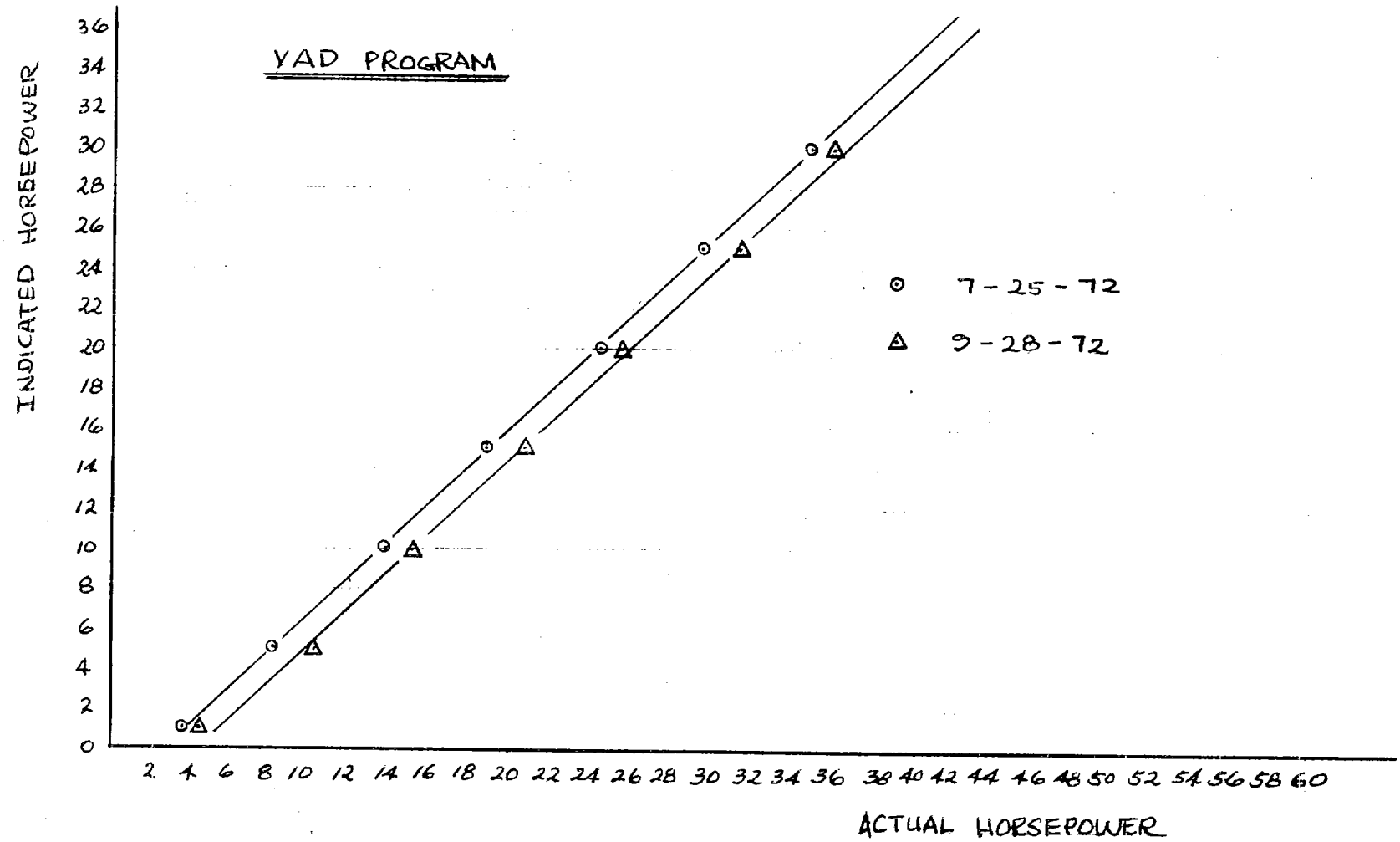
DYNAMOMETER CALIBRATION DATA

DEPT NO.	SHIFT	TRAIN	DATE	P.I.C.
0352	1	VAD	9/28/72	AV/LB/REP

FORMULA: HPd = 0.06073 (Wi/t)

HPd = ABSORBED ROAD HORSEPOWER
0.06073 = CONSTANT
Wi = EQUIVALENT INERTIA
t = ROLL DOWN TIME (SEC.)

IHP			AHP
(1)	0.06073 (4000/ 57.1	t_1) = 4.3	
	0.06073 (4000/ 57.0	t_2) = 4.3	
	0.06073 (4000/ 57.1	t_3) = 4.3	
	0.06073 (4000/	t_4) =	
			4.3 = AVE. AHP
5	0.06073 (4000/ 24.0	t_1) = 10.1	
	0.06073 (4000/ 23.9	t_2) = 10.2	
	0.06073 (4000/ 23.9	t_3) = 10.2	
	0.06073 (4000/	t_4) =	
			10.2 = AVE. AHP
10	0.06073 (4000/ 16.2	t_1) = 15.0	
	0.06073 (4000/ 16.0	t_2) = 15.2	
	0.06073 (4000/ 16.1	t_3) = 15.1	
	0.06073 (4000/	t_4) =	
			15.1 = AVE. AHP
15	0.06073 (4000/11.9	t_1) = 20.4	
	0.06073 (4000/11.5	t_2) = 21.1	
	0.06073 (4000/11.7	t_3) = 20.7	
	0.06073 (4000/11.7	t_4) = 20.7	
			20.7 = AVE. AHP
20	0.06073 (4000/ 9.5	t_1) = 25.6	
	0.06073 (4000/ 9.5	t_2) = 25.6	
	0.06073 (4000/ 9.6	t_3) = 25.3	
	0.06073 (4000/	t_4) =	
			25.5 = AVE. AHP
25	0.06073 (4000/17.6	t_1) = 31.9	
	0.06073 (4000/17.8	t_2) = 31.1	
	0.06073 (4000/ 7.7	t_3) = 31.5	
	0.06073 (4000/	t_4) =	
			31.5 = AVE. AHP
30	0.06073 (4000/16.7	t_1) = 36.2	
	0.06073 (4000/16.8	t_2) = 35.7	
	0.06073 (4000/16.7	t_3) = 36.2	
	0.06073 (4000/	t_4) =	
			36.0 = AVE. AHP



DYNAMOMETER CALIBRATION CURVE

APPENDIX B

TEST DATA FORMAT

TEST VEHICLE INSPECTION AND TEST RESULTS

CAR NO.	RUN NO.	TEST DATE	PROJECT NO.
		/ /	

OWNER

NAME _____ ADDRESS _____

CITY _____ STATE _____ ZIP _____

PHONE _____ APPOINTMENT DATE _____ TIME _____

VEHICLE INFORMATION

MAKE ____ YR ____ MODEL _____ CYL ____ CID ____ A/C ____ CONTROL TYPE ____

ST ____ LICENSE NUMBER _____ SERIAL NUMBER _____ ODOM. _____

VEHICLE INSPECTION

	OIL	COOLENT	HOSE	TRAN. LEVEL	BELTS	TIRES	EXHAUST	BRAKE
OK	☐	☐	☐	☐	☐	☐	☐	☐
BAD	☐	☐	☐	☐	☐	☐	☐	☐

COMMENT: _____ INSP BY: _____

	IDLE RPM	IDLE TIMING B/A	RAD CAP. PRES.	MANIFOLD VACUUM	DISTRI. VACUUM
SPEC					
ACT					

TEST DATA AND RESULTS

INERTIA ____ HP @ 50 MPH ____ GRADE HP ____ TOTAL HP ____ WB ____ DB ____ BARO. P. ____

	ENGINE DATA LOADED AT 50 MPH			
	TIMING B/A	RPM	MANIFOLD VACUUM	DISTRI. VACUUM
WITHOUT VAD				
WITH VAD				

TEMPERATURE DATA			T_{ATM}	T_{CAB}	T_{Wi}	T_{WO}	T_{OIL}	T_{EXH}	TIME TO BOIL MIN.	TIME TO BOIL SEC.
WITHOUT VAD	80°F	LOADED								
		IDLE								
	90°F	LOADED								
		IDLE								
	100°F	LOADED								
		IDLE								
WITH VAD	80°F	LOADED								
		IDLE								
	90°F	LOADED								
		IDLE								
	100°F	LOADED								
		IDLE								

OLSON LABORATORIES INCORPORATED
22805 MICHIGAN AVE., DEARBORN, MICHIGAN 48124

APPENDIX C

TEST FORM INSTRUCTION

TEST FORM INSTRUCTION

The following is the Test Vehicle Instruction on data format. All recordings shall be in accordance with the specified procedure and shall be sufficiently legible for data evaluation.

I. General Provision

(1) Enter only one letter per dash mark.

(2) Make a check mark on box where applicable.

(3) Round up to the closest number when space is not provided for.

II. Headings

CAR NO.:	Assign from 000001 to 100200 First Digit: 0 for uncontrolled vehicles, 1 for controlled vehicles. Last 3 Digits: Numbers of vehicle
RUN NO:	Not required
TEST DATE:	Date of the test performed. e.g. 7-24-72
PROJECT NO:	88807002

III. Owner

NAME:	Name of the owner. e.g. John D. Doe
ADDRESS:	Street Address of the Owner. e.g. 500 E. Orangethorpe Avenue
CITY:	City of the address. e.g. Anaheim
STATE:	State of the address, e.g. California
ZIP:	Zip code of the address. e.g. 92801
PHONE:	Telephone number of the owner including extension. e.g. 870-5000 Ext. 513 work 871-3456 Home

APPT. DATE:	Date of appointment. e.g. 7-24-72
TIME:	Time of appointment. e.g. 8:00 A.M.

IV. Vehicle Information

MAKE:	Manufacturer of car make. e.g. Ford
YEAR:	Year of the vehicle. e.g. 72
MODEL:	Model of the vehicle. e.g. Mustang
CYL:	Number of cylinder of engine. e.g. 4, 6, or 8
CID:	Displacement of engine. e.g. in cubic inch displacement 289 to the nearest cubic inch
A/C:	This indicates the presence of air conditioning
CONTROL TYPE:	This indicates the type of emission control. 0 - no air conditioning 1 - with air conditioning
CONTROL TYPE:	This indicates the type of emission control. 0 - uncontrolled 65 or older 1 - controlled 66 or newer
LICENSE NO:	License number or marker plate
ST:	State vehicle is registered in.
SERIAL NO:	Vehicle serial or identification number used for licensing
ODOM:	Odometer reading in whole miles at the time of test

V. Vehicle Inspection

An inspection will be conducted by the mechanics receiving the vehicle. The critical part of initial inspection is to determine the vehicle is in sound condition which will perform the entire test safely and satisfactorily. If the technician feels that the vehicle is in poor condition and will not start, and or, will not perform the test schedule adequately and safely, the vehicle should be rejected.

The following items should be inspected and checked at the appropriate boxes. Comment if action is taken.

OIL: Check the level of the engine lubrication oil

OK - less than one quart low
BAD - more than one quart low. Action - Add one quart

COOLANT: Check radiator coolant level

OK - Above coil level
BAD - Below coil level. Action - Fill to coil level

HOSE: Inspect conditions of hoses

OK - estimate will not blow during test
BAD - will not last the test performance schedule. Action - replace hose

TRAN LEVEL: With engine on and warmed up, check the level of transmission oil

OK - less than one quart low
BAD - more than one quart low. Action - add a quart

BELTS: Inspect the conditions of belts and their tensions

OK - In good condition and proper tension
BAD - Belts in poor condition and need replacement and/or belts too loose. Action - replace belt and/or adjust belt to proper tension.

TIRE: Tires should be in good running conditions. New tire should not be accepted. Inflate all tires to 45 psi per Federal Register.

OK - Tire in good condition
BAD - Tire will not last the test schedule. Action - reject vehicle

EXHAUST: Exhaust system should be inspected properly for safety reasons. Listen for loud leaky exhaust. Physically inspect for leak and restrict exhaust to check for leak.

OK - Pass the exhaust test

EXHAUST: BAD - Exhaust system needs to be replaced or repaired. Action - reject or repair exhaust respectively.

BRAKE: Check brake for pedal play and hydraulic leak in the system

OK - Pass brake test
BAD - Low pedal height or brake would not hold. Action - adjust brake or reject vehicle respectively.

COMMENT: State action taken if any BAD item is checked.

INSPECTED BY: Initialed by mechanics

The following description will aplly to the vehicle adjustment.

SPEC: Manufacturers specification. Tolerances and ranges as specified. If not specified, judge as mechanic's common practice.

ACTUAL: The actual reading measured, if adjustment is made, enter the adjusted reading.

IDLE RPM: The engine speed at idle condition, state N for neutral and D for drive when rpm is taken. e.g. 6 0 0 N

IDLE TIMING: The ignition timing at idle engine speed, state A for After Top Dead Center and B for BTDC. e.g. 1 2 . 0 B

RAD CAP PRES: The cooling system operating pressure. (Note: The radiator pressure cap must be capable to withstand such pressure. e. g. 0 5 . 0

MANIFOLD VACUUM: Vacuum at manifold in inches of Hg. No manufacturer's specification. e.g. 0 5 . 0

DISTRI VACUUM: Vacuum to the distributor in inches of Hg. e.g. 0 0 . 4

Note: Mechanics should also check the vacuum and centrifugal advances are in operable condition.

VI. Test Data & Results

INTERTIA: Inertia of the vehicle class as per Federal Register. e.g. 2 0 0 0

HP @ 50 MPH: Actual horsepower specified by Federal Register per vehicle inertia class at 50 mph, volume 35, No. 219, Nov. 10, 1970. Set dyno to this actual HP initially.

GRADE HP: Leave blank

TOTAL HP: Increase the dyno power until timing starts to fall approximately one degree from the initial operating condition. Record the indicated HP.

WB: Wet bulb temperature at beginning of test outside the room on psychrometer

DB: Dry bulb temperature at beginning of test outside the room on psychrometer.

BARO P: Barometer Pressure at beginning of test outside the room

(a) Engine loaded at indicated total HP measure and record the following as defined in Section V with and without the VAD device:

Timing

RPM

Manifold Vacuum

Distri. Vacuum

(b) Temperature Data

TATM: Temperature of air under hood

TCAB: Temperature of carburetor intake air

TWI: Temperature of radiator water inlet

TWO: Temperature of radiator water outlet

TOIL: Temperature of engine oil

TEXH: Temperature of exhaust

LOADED: Means the temperature taken is the equilibrium temperature when the vehicle is operating at the indicated total HP 50 mph head wind (@ 50 mph speed)

IDLE: Means the temperature taken is the maximum temperature when the vehicle is operating at idle condition

TIME TO BOIL : Time to reach the maximum temperature from beginning of idle condition or actual time to boil.

APPENDIX D

VEHICLE TEMPERATURE DATA

RK SHEET – 27 COLUMN
RM 1043 (R5-68)

UNCONTROLLED VEHICLES

SUBJECT TEMPERATURE DIFFERENTIALS

(WITH VAD – WITHOUT VAD) / WITHOUT VAD

PREPARED BY

APPROVED BY

CAR IDENTIFYING NUMBER	DESCRIPTION	TEST DATE	Exhaust temp. (LOADED) 80°F		90°		100°		Exhaust temp. (IDLE) 80°		90°		100°		Water In temp (Loaded) 80°		90°		100°		Water In temp. (IDLE) 80°		90°		100°		Water Out temp. (LOADED) 80°		90°		100°	
001	63 valiant 6	11-8	60/350	17.14	17/355	4.79	-20/420	-4.76	120/170	70.59	10/180	5.56	-30/200	-16.0	0/167		0/192		-4/215		-3/205		3/207		-2/221		-2/180		0/185		-3/198	
002	64 Valiant 6	7-31	130/650	20.0	90/690	13.04	100/685	14.60	110/330	33.33	70/370	18.92	40/390	10.26	-4/180		4/162		3/191		-2/194		5/197		4/210		-4/170		3/175		2/185	
003	65 Impala 8	7-31	70/590	11.86	65/600	10.83	105/560	18.75	-5/395	-1.27	-70/500	-14.0	25/395	6.33	-3/189		-3/191		2/190		8/199		10/200		6/205		-3/183		0/184		1/187	
004	65 Mustang 8	8-2	90/610	14.75	65/630	10.32	80/640	12.50	35/435	8.05	65/405	16.05	60/430	13.95	4/160		-1/180		2/190		4/190		0/203		3/212		4/158		-1/172		2/183	
005	64 Rambler 8	8-4	20/490	4.08	-10/530	-1.89	-5/515	-0.97	5/330	1.52	-10/355	-2.82	5/340	1.47	-4/176		-2/182		0/186		2/184		-1/191		4/196		-1/159		-2/170		0/177	
006	65 Mustang 6	8-4	-25/640	-3.91	-45/645	-6.98	-15/645	-2.33	-20/420	-4.76	-20/420	-4.76	-20/430	-4.65	-19/194		-9/198		-10/207		-7/217		-10/223		-15/234		-9/177		-14/186		-12/197	
007	64 Buick 8 B	8-4	35/600	5.83	40/580	6.90	40/610	6.56	25/365	6.85	35/350	10.0	B/365		7/219		-2/236		-3/244		8/224		8/238		B/247		B/190		0/205		-2/212	
008	60 T-bird 8	8-8	80/656	13.57	67/678	9.88	42/710	5.92	30/305	9.84	10/340	2.94	10/330	3.03	0/176		-4/184		-1/192		-2/198		0/201		1/215		3/163		-4/175		-1/184	
009	64 Olds 8	8-16	75/535	14.02	50/570	8.77	50/575	8.70	40/320	12.50	80/340	8.82	25/350	7.14	-4/186		0/184		0/192		+4/207		3/211		4/218		-2/177		-1/179		-1/187	
010	63 Chry 8	8-17	40/760	5.26	35/770	4.55	20/770	2.60	25/415	6.02	20/415	4.82	10/410	2.44	-1/175		-2/185		-4/195		-4/199		-6/211		-6/221		-1/175		-2/185		-4/195	
011	65 Olds 8	8-17	80/630	12.70	0/690	0	50/640	7.81	50/370	13.51	-10/430	-2.33	15/415	3.61	-3/182		-1/187		-4/200		+6/216		-1/232		3/237		-2/174		-1/186		-5/200	
012	61 Falcon 6	8-16	150/660	22.73	190/630	30.16	*640		80/330	24.24	60/330	18.18	7/330		0/174		3/178		*190		12/183		15/187		*200		3/164		2/169		*182	
013	63 T-bird 8	8-18	105/600	17.50	90/585	15.38	85/590	14.41	65/385	16.88	30/400	7.50	20/405	4.94	6/178		3/192		5/200		8/198		3/215		5/225		5/171		2/185		4/195	
014	63 Dodge	8-21	40/610	6.56	40/610	6.56	55/610	9.02	20/340	5.88	15/355	4.23	40/340	11.76	3/184		-2/194		3/200		+3/212		0/220		-4/227		3/177		-2/188		3/194	
015	64 Dodge	8-22	35/430	8.14	30/430	6.98	45/445	10.11	25/305	8.20	30/300	10.0	10/320	3.13	-2/207		+4/215		-4/232		-6/221		1/228		-1/241		5/195		4/207		-4/224	
016	64 Falcon 8	8-25	100/670	14.93	90/700	12.86	50/700	7.14	70/210	17.07	70/430	16.28	20/460	4.35	-17/205		-19/215		-5/215		-10/230		-3/235		-1/240		-16/197		-5/199		-14/219	
017	65 Ford 8 B	8-28	0/590	0					B/B						0/194						B						-1/171					
018	64 Olds 8	8-28	-5/585	-0.85	30/540	5.56	30/545	5.50	10/360	-2.78	0/350	0	20/350	5.71	-6/195		-4/196		-3/200		4/206		2/211		2/215		-3/188		-4/190		-2/194	
019	60 Impala 8	8-29	110/590	18.64	105/580	18.10	85/575	14.78	60/330	18.18	70/340	20.59	40/350	11.43	7/174		7/180		7/189		11/190		8/199		9/207		8/167		8/176		9/185	
020	64 Fairlane 8	8-31	85/600	14.17	60/610	10.0	65/610	10.66	10/400	2.50	10/350	2.86	45/335	13.43	-2/188		1/197		-5/210		-2/214		0/222		-4/236		-2/175		-1/185		-3/195	
021	63 Riviera 8 B	9-1																														
022	65 MALABU 8	8-31	45/660	6.82	50/645	7.75	40/650	6.15	40/305	13.11	45/320	14.52	75/295	25.42	-1/184		-1/191		-1/199		5/206		5/214		2/222		0/178		-2/187		0/195	
023	65 Chevelle 6	8-31	45/665	6.77	40/675	5.93	35/665	5.26	-50/345	-14.49	0/355	0	0/330	0	0/192		-4/191		-1/205		7/196		2/204		9/211		1/174		-5/184		0/193	
024	65 Tempest 8	9-5	110/420	26.19	4/530	0.75	75/475	15.79	31/212	11.83	13/261	5.0	23/232	9.93	8/177		0/192		-2/196		11/192		4/205		6/211		8/163		0/180		0/185	
025	65 Colony 8	9-6	4/436	0.92	20/400	5.0	13/412	3.16	-35/365	-9.43	41/252	16.27	10/280	3.57	1/204		-1/213		-7/220		-2/216		-2/229		-6/237		2/198		-2/210		-7/217	
026	62 Tempest 4	9-6	1/471	0.21	47/440	10.68	64/436	14.68	10/310	3.23	33/299	11.04	48/302	15.89	10/170		-8/193		-6/199		13/187		0/201		2/213		8/159		-9/182		-6/187	
027	65 Chevelle 6	9-7	-6/396	-1.52	25/399	7.62	24/406	5.91	121/177	68.68	127/300	42.33	29/298	9.73	1/195		-6/195		7/198		-1/200		-5/211		5/214		1/175		-6/186		1/190	
028	64 Colony 8 B	9-14	86/694	12.57	69/701	9.84	55/719	8.63	28/361	7.76	30/384	7.81	6/6		5/193		-1/208		-3/215		6/225		6/243		6/6		1/177		1/190		-2/198	
029	64 Ecomobile 6	9-18	-250/730	34.25	—/730		—/906		22/218	11.58	—/228		—/215		-4/219		—/214		—/217		5/232		—/230		—/242		-8/190		—/199		—/201	
030	63 Impala 8B	9-18	17/405	4.20	33/392	8.42			5/270	1.85	B/255				3/216		1/224		—/—		-8/224		B/230		—/—		-1/198		0/207		—/—	
031	62 Wildcat 8	9-19	9/412	2.18	85/400	5.50	20/382	5.24	5/276	1.85	45/245	18.37	21/272	7.63	-11/207		1/224		7/219		-3/224		1/231		9/235		-11/192		0/206		7/203	
032	62 Comet 6	9-19	116/856	13.88	130/800	11.25	152/778	19.54	36/439	8.20	44/418	10.53	56/372	15.09	-3/193		-2/198		3/207		0/224		3/229		7/240		-3/177		1/184		-2/191	
033	64 Biscayne 8	9-20	75/652	11.50	45/683	6.79	17/660	2.62	21/611	7.46	32/356	9.14	-6/328	-1.83	2/199		0/180		-12/195		0/193		1/195		-4/212		2/170		0/177		-12/193	
034	63 Chevelle 6	9-21	46/462	9.96	11/419	2.35	29/470	6.17	10/338	2.96	2/333	0.6	56/311	18.0	4/196		-2/198		-1/198		2/219		3/213		2/213		0/175		-1/178		1/180	

MENTS:

BY H.R.C ORGN. DATE SUBJECT 88880-7002 PAGE — OF — PAGE — OF —

BY ORGN. DATE

Water Out temp. (IDLE) 80°	90°	100°	Water (In - Out) temp. W/O/W 80°	90°	100°	OIL temp (LOADED) 80°	90°	100°	OIL TEMP (IDLE) 80°	90°	100°
-1/193	4/195	-3/210	7/9	7/7	7/6	9/197	-2/202	-6/213	-4/196	5/198	-4/213
-2/184	5/185	3/198	10/10	7/8	6/7	-3/217	-1/220	-1/229	-2/212	3/210	3/222
7/189	11/187	5/195	7/5	7/4	3/4	-4/259	-2/261	0/262	-8/250	-3/250	-2/250
3/182	0/195	2/205	8/8	8/8	7/7	7/202	-8/220	0/230	3/199	-2/212	2/523
2/172	0/180	4/188	17/16	12/12	9/9	-1/214	-5/222	-3/225	0/205	-2/212	0/516
-6/203	-10/210	-15/224	17/16	12/15	10/12	-2/236	-10/251	-10/260	-7/224	-15/235	-4/245
3/199	6/213	8/220	29/28	31/29	32/31	11/247	-6/270	-4/270	8/242	-8/264	8/270
-1/188	3/190	1/205	13/10	9/9	8/8	1/222	-7/234	-3/240	1/210	-4/220	-2/228
4/197	-1/203	2/209	9/7	5/6	5/6	-4/235	-6/240	-2/244	-3/223	-1/227	2/232
-2/187	-4/201	-2/210	0/0	0/0	0/0	5/249	-6/265	-3/271	5/240	-6/257	-4/261
4/213	0/226	7/224	8/7	1/1	0/1	-3/550	-2/252	-5/265	0/537	-2/245	-3/256
1/175	14/181	*/193	10/7	9/10	8/*	1/213	-1/221	*/234	4/202	1/209	*/220
8/196	4/210	4/221	7/8	7/8	5/6	4/252	-3/265	2/272	5/240	-1/252	3/262
3/303	0/210	-2/218	7/7	6/6	6/6	6/214	-6/229	0/233	8/207	-3/220	0/225
-5/210	0/218	7/232	12/5	8/8	8/8	-7/191	-5/207	1/224	-7/185	-8/211	1/222
-14/223	-5/229	-3/234	8/7	16/2	?/-4/5	-7/364	-10/275	-16/283	-10/235	-8/263	-9/270
B			19/20			-2/243			B		
3/201	4/204	-1/213	7/6	6/6	6/5	-8/245	-7/245	-6/252	-3/231	-4/234	-3/239
9/185	5/195	8/201	7/6	4/3	4/2	11/222	1/235	5/239	11/218	5/230	7/234
-2/196	0/205	-2/217	13/13	12/13	15/13	-7/235	-5/241	-13/257	-5/220	-2/226	-5/240
5/199	5/206	1/215	6/5	4/5	4/3	-1/240	-6/250	—	-/205	—	—
8/182	6/191	8/199	8/7	7/8	7/6	2/268	-16/270	0/277	2/219	-8/215	1/223
9/182	2/194	6/201	14/14	12/12	11/9	11/226	-3/240	2/244	1/225	-1/233	2/238
2/207	-1/-1	-5/230	6/5	3/4	3/3	-1/264	-6/262	-8/265	-17/249	-4/247	-8/253
12/173	-1/193	0/200	11/13	11/12	12/12	9/161	-6/185	-1/172	7/183	-6/205	1/207
-1/188	-2/199	3/204	10/10	7/9	8/9	2/268	-8/223	4/228	10/196	-9/221	4/223
6/213	0/232	B/B	16/15	18/16	17/16	7/264	-5/280	-3/283	5/249	-1/259	B/B
9/215	—/220	—/221	17/21	15/—	16/—	-9/200	—/264	—/265	10/220	—/234	—/230
-7/205	B/212	—/—	18/20	17/18	—/—	-10/255	+1/261	—/—	-9/242	B/256	
-1/216	2/212	10/207	19/18	18/19	16/16	-9/255	0/260	3/253	-10/242	3/247	5/245
0/225	5/230	2/238	16/16	14/15	16/17	-16/241	-3/250	0/256	-10/240	-2/239	-1/243
3/186	1/192	-1/197	5/5	3/3	2/2	19/234	-2/236	-4/239	1/222	2/223	-1/225
3/195	-3/200	2/201	21/25	20/18	18/18	-6/232	-6/239	-2/239	-5/230	-2/232	1/232

EXHAUST TEMP. (LOADED) 80°F		90°F		100°F		EXHAUST TEMP. (IDLE) 80°F		90°F		100°F	
60/790	7.59	74/775	9.55	45/810	5.56	15/455	3.30	1/481	0.21	0/480	0
-60/847	-7.08	-26/796	-32.7	-60/857	-7.0	25/562	4.45	-15/585	-2.56	15/585	2.56
89/656	13.57	67/678	9.88	42/710	5.92						
70/900	7.78	45/940	4.79	60/990	6.38	15/560	2.68	-5/585	-0.85	-25/575	-4.35
100/640	15.63	85/655	12.98	50/655	7.63	40/410	9.76	15/415	3.61	35/395	8.86
70/755	9.27					B					
55/555	9.91	25/560	4.46	30/540	5.56	50/400	12.50	20/410	4.88	25/410	6.10
100/750	13.33	135/700	19.29	130/700	18.57	45/325	13.85	35/340	16.18	25/350	7.14
110/690	15.94	75/700	10.71	100/700	14.29	20/465	4.30	30/435	6.90	30/445	6.74
40/765	5.23	60/755	7.95	30/775	3.87	10/475	2.11	50/455	10.99	35/460	7.61
65/705	9.22	80/700	11.43	70/710	9.86	40/475	8.42	60/450	13.33	20/480	4.17
35/595	5.88	93/520	17.88	140/550	25.45	17/453	3.75	32/433	7.39	65/460	14.13
44/888	4.95	65/850	7.65	38/852	4.46	-18/500	-3.60	23/510	4.51	0/510	0
45/495	9.09	88/485	18.14	70/490	14.29	60/395	15.19	48/412	11.65	50/415	12.05
72/710	10.14	63/715	8.81	101/700	14.43	102/410	24.88	27/491	5.50	31/491	6.31
68/782	8.70	65/787	8.26	73/777	9.40	14/582	2.41	17/583	2.92	B/B	
215/785	27.39	—/790		—/842		55/480	11.46	—/485		—/490	
8/692	1.16	42/680	6.18	—/—		-5/460	-1.09	B/447		B/B	
0/700	0	41/680	6.03	22/659	3.34	-5/460	-1.09	58/432	13.43	28/452	6.19
—/—		—/—		—/—		20/620	3.23	52/600	8.67	15/652	2.30
107/700	15.29	45/717	6.28	13/702	1.85	23/435	5.29	33/430	7.67	28/437	6.41
54/803	6.72	52/777	6.69	63/787	8.01	0/540	0	8/532	1.50	27/523	5.16

WORK SHEET – 27 COLUMN
FORM 1043 (R5-69)

SUBJECT UNCONTROLLED VEHICLES

PREPARED B

APPROVED B

IDENTIFYING NUMBER	DESCRIPTION	TEST DATE	Exhaust temp. (LOADED) 80°F		90°		100°		Exhaust temp. (IDLE) 80°		90°		100°		Water In temp. (Loaded) 80°	90°	100°	Water In temp (IDLE) 80°	90°	100°	Water Out temp (LOADED) 80°	90°	100°
035	62 Belair 8	9-21	57/511	11.15	50/512	9.96	65/495	13.13	33/235	14.04	23/241	9.54	49/230	21.30	-4/174	0/179	-2/184	6/190	7/195	6/200	-4/169	0/179	-1/179
036	61 Invicta 8	9-22	60/512	10.49	43/515	7.23	65/555	11.71	18/292	6.16	2/307	0.65	1/308	0.32	6/185	3/192	4/197	4/223	3/229	4/233	5/170	-3/176	-2/182
037	63 Grand prix 8	9-22	28/502	5.58	60/442	13.57	28/412	6.80	6/219	2.74	28/212	13.86	18/190	9.47	28/191	7/197	-5/219	10/203	3/233	0/233	-14/196	3/207	-4/222
038	65 Impala 8	9-28	70/595	11.76	44/588	7.48	49/592	8.28	43/287	14.98	12/290	4.14	24/285	8.42	0/184	1/187	-1/197	0/209	4/211	5/220	0/171	0/177	-1/186
039	63 Galaxie 8 B	9-29	44/608	7.24	30/621	4.83	B/B		-11/479	-23.17	170/490	34.69	0/B		0/182	3/187	B/B	2/221	6/232	B/B	-2/179	-2/184	6/B
040	64 GTO 8	9-29	64/528	12.12	78/502	15.54	79/470	16.81	34/275	12.36	4/263	1.52	24/241	9.96	0/187	2/189	8/196	8/200	17/201	20/204	0/176	3/178	8/180
041	65 Buick 6	10-2	64/578	11.07	51/539	9.46	80/530	15.09	20/379	7.17	27/260	10.38	12/378	4.32	1/169	-1/173	0/180	0/190	-1/195	4/198	0/162	0/167	0/177
042	57 Chev 8	10-4	55/605	9.09	15/615	2.44	51/590	8.64	-14/304	-4.61	2/280	0.71	12/278	4.32	-4/183	-5/197	-5/209	-4/222	-4/235	-1/239	-9/168	-4/182	-5/193
043	61 Lincoln 8	10-4	32/508	6.30	84/478	17.57	55/500	11.00	30/340	8.82	70/330	21.21	14/341	4.11	3/169	3/175	-1/184	0/194	3/202	0/210	1/160	3/167	1/176
044	65 Datsun 4 B	10-4	65/865	7.51	30/935	3.21	40/800	5.00	27/218	12.39	-2/242	-0.83	B/270		1/187	1/194	3/200	-3/218	-3/220	B/224	-1/154	-1/160	-12/167
045	60 Pont 8	10-5	33/412	8.01	23/435	5.29	30/420	7.14	-15/255	-5.88	-15/235	-6.38	-6/241	-2.49	-2/170	-7/182	12/175	14/191	-1/214	0/214	-3/167	-6/178	+11/172
046	64 Amer 8	10-9	33/545	6.06	28/540	5.19	21/532	5.26	7/289	2.42	0/295	0	10/282	3.55	-3/178	-3/184	-3/191	-3/210	0/217	-4/224	5/174	3/182	-3/187
047	61 Impala 8	10-9	37/525	7.05	56/502	11.16	57/493	11.56	0/340	0	10/330	3.03	33/317	10.41	-1/173	4/181	3/188	1/196	8/202	4/210	-1/164	3/172	2/179
048	62 Polara 8	10-10	-36/528	-6.82	-96/599	-16.03	18/490	3.67	-52/272	-19.12	-23/289	-7.96	12/241	4.98	-19/176	-12/194	-7/192	-16/218	-18/235	-6/228	-17/179	-12/190	-6/188
049	63 Dart 6	10-10	-42/540	-7.78	41/790	5.19	62/778	7.97	35/210	16.67	-8/268	-2.99	101/189	53.44	-1/191	5/198	-1/208	1/212	2/215	-2/221	-4/137	5/138	-3/148
050	65 Catalina 8	10-11	50/520	9.62	50/510	9.80	16/519	3.08	0/260	0	30/270	11.11	0/280	0	2/173	-1/176	-1/179	11/189	8/192	8/197	2/167	-1/170	-1/174
051	63 Nova 6	10-11	61/628	9.71	138/702	19.66	40/552	7.25	3/229	1.31	-65/316	-20.57	0/215	0	-2/185	2/186	-1/197	3/191	4/196	0/205	-1/154	0/158	-1/169
052	64 WG 8	10-11	52/698	7.45	5/725	0.69	65/680	9.56	14/328	4.27	6/340	1.76	30/320	9.38	-2/187	-5/195	-2/200	5/199	3/207	6/211	-2/181	-5/190	-2/195
053	63 Custom 880 8B	10-12	80/625	12.80	90/600	15.00	B/B		50/330	15.15	B/B		B/B		-3/195	3/199	B/B	-2/232	0/B	B/B	-2/187	3/192	B/B
054	65 Barracuda 8	10-12	39/552	7.07	38/550	6.91	35/545	6.42	31/310	10.00	67/338	19.82	15/335	4.48	-4/171	-2/179	-4/188	1/192	3/200	4/206	-2/153	-1/161	-3/170
055	61 Monterey 8	10-12	40/535	7.48	30/530	5.66	26/520	5.00	18/302	5.96	30/295	10.17	15/325	4.62	0/162	3/168	0/177	1/212	4/221	0/227	0/155	3/162	0/172
056	63 Chev II 6	10-13	17/641	2.65	33/622	5.31	-9/669	-1.35	-9/308	-2.92	11/288	3.82	-45/329	-13.68	-12/203	-3/208	-13/225	-10/212	-1/217	-8/229	-11/191	-3/197	-13/213
057	62 Impala 8	10-13	29/500	5.80	40/501	7.98	32/499	6.41	5/251	1.99	10/258	3.88	51/250	20.40	-5/195	0/203	-3/212	-2/217	5/225	2/233	-5/181	-1/188	-3/197
058	65 Dart 6 B	10-13	102/608	16.78	58/610	9.51	90/590	15.25	143/403	35.48	63/370	17.03	B/363		3/189	4/195	2/206	9/235	6/237	B/242	2/181	4/187	0/198
059	63 Nova B	10-16	-		-		-																
060	63 Deville 8	10-16	50/542	9.23	48/558	8.60	48/570	8.42	1/301	0.33	19/291	6.53	-21/339	-6.19	-2/184	0/196	-3/210	-1/204	1/216	-2/229	-2/178	1/189	-3/204
061	62 Belvedere 8	10-16	67/542	12.36	78/531	14.69	77/523	14.72	16/227	7.05	26/232	11.21	51/260	19.62	0/192	2/201	0/212	-2/224	4/231	-3/241	-1/185	3/193	0/204
062	63 Monterey 8	10-17	27/583	4.63	5/570	0.88	2/565	0.35	11/286	3.85	-15/290	-5.17	-35/326	-10.74	-1/183	-3/187	-8/195	-6/228	-3/228	-5/222	-3/170	-6/177	-7/184
063	62 American Custom 6	10-18	73/547	13.35	48/570	8.42	61/539	11.32	-3/228	-1.32	-3/250	-1.20	9/231	3.90	9/185	6/198	15/205	6/202	5/210	10/221	9/177	6/189	11/197
064	65 Fury I 8	10-17	0/564	0	13/568	2.29	-5/575	-0.87	-1/302	-0.33	3/300	1.00	-6/325	-1.85	0/184	1/189	-2/198	4/203	0/213	-2/219	-2/172	0/180	-1/188
065	63 Sport Fury 8	10-18	65/715	9.09	69/711	9.70	93/685	13.58	12/350	3.75	32/388	8.25	70/360	19.44	-3/181	-3/185	-1/190	-4/206	-3/212	0/216	-5/168	-3/178	-1/184
066	62 Electra 8 B	10-18	38/480	7.92	B/B		B/B		B/B		B/B		B/B		13/227	B/B	B/B	B/B	B/B	B/B	-10/210	B/B	B/B
067	63 Impala 8	10-19	70/692	10.12	55/685	8.03	45/705	6.38	-5/335	-1.49	25/315	7.94	15/355	4.23	2/178	1/185	-1/194	8/200	16/209	6/216	1/157	0/166	0/175
068	65 Special 8 B	10-19	10/640	1.56	B/B		B/B		B/B		B/B		B/B		-18/230	B/B	B/B	B/B	B/B	B/B	-15/207	B/B	B/B

MENTS:

ORGN. _____ DATE _____ SUBJECT TEMPERATURE DIFFERENTIALS PAGE ___ OF ___

ORGN. _____ DATE _____ (WITH VAD – WITHOUT VAD / WITHOUT VAD)

Out temp. (IDLE) 90°		Out temp. (IDLE) 100°		Water (In-Out) temp. WO/WVAD 80°		90°		100°		O/L Temp (LOADED) 80°		90°		100°		O/L TEMP (IDLE) 80°		90°		100°	
6	184	6	189	5	5	5	5	5	4	6	244	-2	247	-5	252	-11	228	0	232	-2	237
4	216	4	220	15	16	16	16	15	17	-4	249	2	253	1	256	1	235	1	241	4	243
4	219	-2	229	3	-3	-10	-6	-3	-4	-22	268	0	274	-7	282	-17	253	2	260	0	264
3	201	1	209	13	13	10	11	11	11	-5	232	-2	235	-6	244	-2	221	-1	225	-3	233
1	215	B	B	3	5	3	8	B	B	-8	252	-1	256	B	B	-7	242	1	246	B	B
13	187	16	191	11	11	11	10	10	10	-3	253	1	250	3	253	1	237	4	237	8	238
0	185	2	191	7	8	6	5	3	3	-3	221	-3	223	-5	230	0	208	-2	212	0	216
-1	216	0	223	15	20	15	14	16	16	-9	264	-6	275	-10	276	4	248	-14	260	3	250
3	194	1	202	9	11	8	8	8	6	-8	242	2	244	-6	254	-3	220	-4	225	-2	232
9	167	B	178	33	35	34	36	33	B	-2	257	0	262	-5	271	4	241	0	242	-7	255
-2	210	0	211	3	4	4	3	3	4	-15	238	-18	250	0	253	-25	212	-9	210	-7	208
1	207	-3	214	4	6	5	5	4	4	-10	237	-1	240	-5	245	-6	230	-1	235	-5	241
6	190	3	198	9	9	9	10	9	10	-7	219	1	224	-2	232	-5	212	3	217	0	225
-14	220	-5	215	-3	-5	4	4	4	3	-23	253	-11	265	-8	260	-21	243	-11	254	-8	250
4	173	2	174	54	57	60	60	60	62	-2	217	1	222	-6	233	0	214	5	216	-4	230
3	183	6	189	6	6	6	6	5	5	1	232	-3	230	7	233	0	217	1	217	-5	225
7	177	0	188	31	30	28	30	28	28	-6	213	3	212	-5	223	-3	207	2	209	-3	219
2	197	6	201	6	6	5	5	5	5	-4	233	-6	229	-5	244	-1	221	-3	228	0	232
B	B	B	B	7	7	7	7	B	B	-5	240	0	245	B	B	-5	237	B	B	B	B
4	186	0	194	18	16	18	17	18	17	-8	231	-2	236	-8	246	-4	220	0	229	-6	238
2	219	-1	225	7	7	6	6	5	5	-6	243	-5	245	-2	237	-6	213	3	216	1	222
-2	206	-8	217	12	11	11	11	12	12	-11	235	3	236	-11	253	-11	228	2	230	-16	245
2	206	-1	212	14	14	15	16	15	15	-7	249	-1	256	-5	263	-5	236	1	243	-1	252
3	227	B	232	8	9	8	8	8	10	-8	248	2	250	4	252	-4	250	2	251	B	256
0	207	-3	220	6	6	7	6	6	6	-7	241	-2	250	-6	263	-6	228	0	237	-3	248
6	221	-3	231	7	8	10	7	8	8	-3	239	-1	246	-6	259	-5	238	1	246	-2	257
-2	219	-6	224	13	15	10	13	11	10	-8	251	-10	254	-12	254	-6	238	-8	240	-8	242
6	204	8	217	8	8	9	9	8	6	2	211	6	219	10	227	2	203	3	210	6	220
1	203	-2	210	12	14	9	10	10	9	0	226	1	228	0	233	0	217	1	221	-3	230
-2	202	0	208	13	15	7	7	6	6	-9	242	-1	250	-4	252	-5	242	-5	248	-1	249
B	B	B	B	17	14	B	B	B	B	-21	287	B	B	B	B	B	B	B	B	B	B
15	183	4	190	21	22	19	20	19	18	-1	235	0	238	-6	248	-2	227	2	230	-4	240
B	B	B	B	-23	20	B	B	B	B	-23	278	B	B	B	B	B	B	B	B	B	B

EXHAUST TEMP (LOADED) 80°F		90°F		100°F		EXHAUST TEMP (IDLE) 80°F		90°F		100°F	
115	22.10	58	11.55	55	9.73	42	12.73	52	16.25	65	20.63
525		550		565		330		321		315	
52	6.86	66	8.55	83	11.19	11	2.38	-2	0.43	10	2.16
458		472		442		462		470		462	
43	7.82	90	17.93	46	9.39	10	2.51	-22	5.46	49	50.91
550		502		490		399		403		275	
84	12.82	62	9.54	75	11.54	60	13.33	35	7.78	35	7.78
555		550		550		450		450		450	
57	7.76	61	8.47	B		-6	-1.17	289	56.0	B	
735		720		B		511		510		B	
70	10.45	81	12.48	115	19.17	67	16.75	23	5.72	41	10.51
670		649		600		400		462		390	
105	15.91	86	13.63	88	13.60	43	9.66	30	6.98	13	2.92
660		631		697		445		430		445	
82	11.71	45	6.21	84	11.91	-3	-0.63	6	1.28	28	6.06
700		725		705		473		469		462	
96	11.68	136	16.92	111	13.54	40	8.16	60	12.0	7	1.40
822		804		820		490		500		501	
—		—		—		21	4.78	70	15.56	B	
987		940		960		439		450		490	
44	9.21	5	1.01	44	9.40	20	5.0	12	3.17	37	9.79
478		495		468		400		378		378	
28	4.98	13	2.30	15	2.70	2	0.49	-7	-1.71	-8	-2.04
562		565		555		408		409		392	
60	11.11	65	12.15	64	12.12	23	5.68	25	6.10	37	9.20
540		535		528		405		410		402	
-34	-5.07	-67	-9.37	58	9.83	-19	-4.19	-12	-2.61	-2	-0.47
671		715		590		453		460		428	
68	8.00	40	4.60	69	8.12	19	3.88	21	4.13	17	3.37
850		870		850		490		509		505	
65	9.49	77	11.81	40	5.97	28	6.66	45	10.84	23	5.12
685		652		670		420		415		430	
98	-14.80	135	-20.66	92	-14.15	29	-7.44	-30	-6.79	8	-1.91
662		605		650		390		442		418	
57	9.08	20	3.08	65	10.48	25	5.95	27	6.35	45	10.84
628		650		620		420		425		415	
-5	-0.83	100	16.67	B		-60	-14.29	B		B	
600		600		B		420		B		B	
44	7.50	45	7.63	32	5.33	20	4.82	90	20.69	31	7.06
587		590		600		415		435		439	
52	7.43	43	6.25	33	4.91	18	3.90	18	3.98	15	3.26
700		688		672		462		462		460	
-3	-0.44	6	0.90	5	0.75	-5	-1.23	11	2.74	-15	-3.61
676		668		671		406		401		416	
46	5.97	62	8.08	46	6.01	18	4.39	19	4.53	59	13.79
771		767		766		410		419		428	
—		—		—		199	25.48	101	13.24	B	
982		978		955		781		763		750	
60	7.92	68	8.81	67	8.59	1	0.19	27	5.29	24	4.60
758		772		780		519		510		522	
106	14.34	110	14.71	108	14.61	1	0.23	12	2.73	29	6.17
739		748		739		433		440		470	
28	3.79	16	2.19	15	2.08	45	9.16	-16	-3.21	1	0.20
739		732		720		491		498		502	
94	-15.28	60	-9.38	101	-16.56	17	-4.17	10	-2.35	19	-4.46
615		640		610		408		425		426	
2	0.23	6	0.70	-3	-0.35	4	0.70	4	0.72	5	0.88
868		862		856		574		553		566	
75	9.49	82	10.41	105	13.64	-5	-1.15	5	1.08	20	4.27
790		788		770		435		465		468	
28	3.68	B		B		B		B		B	
760		B		B		B		B		B	
89	12.03	64	8.65	55	7.33	10	2.25	28	6.48	30	6.67
740		740		750		445		432		450	
25	3.55	B		B		B		B		B	
705		B		B		B		B		B	

RK SHEET – 27 COLUMN

RM 1043 (R5-65)

SUBJECT UNCONTROLLED VEHICLES

PREPARI

APPROVE

ENTIFYING NUMBER	DESCRIPTION	TEST DATE	Exhaust Temp. (Loaded) Tailpipe 80°		90°		100°		Exhaust Temp (Idle) 80°		90°		100°		Water In temp (Loaded) 80°		90°		100°		Water In temp (Idle) 80°		90°		100°		Water Out temp (Loaded) 80°		90°		100°	
069	61 Tempest · 4 B	10-19	55/635	8.66	62/620	10.00	50/620	8.06	40/370	14.81	-5/281	-1.79	-/B	.	-7/205	.	4/212	.	6/225	.	-2/223	.	10/230	.	B/243	.	-3/185	.	6/193	.	-1/206	.
070	65 Custom 8	10-20	45/725	6.21	60/790	8.70	35/705	4.96	50/360	13.89	50/360	13.89	14/345	4.06	0/186		-4/191		-3/197		0/207		0/212		-3/221		-1/173		-5/180		-4/187	
071	65 Catalina 8	10-20	60/385	15.58	15/395	3.80	15/425	3.53	35/185	18.92	-5/205	-2.44	5/215	2.33	-4/187		-2/192		-6/206		14/203		11/209		4/221		-3/178		-3/185		-6/199	
072	64 Cutlass 8	10-20	22/560	3.93	36/562	5.34	35/560	6.25	68/250	27.20	118/162	72.84	10/270	3.70	-6/180		-3/189		-7/199		-3/207		2/215		-3/204		-5/165		-2/173		4/183	
073	62 LeSabre 8	10-23	-30/550	-5.45	23/532	4.32	102/510	19.61	45/315	14.29	0/315	0	95/275	34.55	-4/191		-3/196		-2/215		-4/195		-2/200		3/209		-5/175		-4/182		-3/190	
074	63 Olds 98 8	10-23	90/570	15.79	90/565	15.93	70/570	12.28	-38/345	-8.70	-23/295	-7.80	20/270	7.41	3/180		4/183		0/192		9/211		12/203		7/215		3/168		5/170		0/180	
075	63 Convert 8	10-23	30/710	4.23	50/700	7.14	45/695	6.47	-5/375	-1.33	-10/400	-2.50	13/380	3.95	-26/190		-1/193		0/196		-17/218		-2/208		-1/231		-5/165		1/171		-1/181	
076	60 Olds 88 8	10-24	61/415	13.12	61/459	13.29	69/450	15.33	14/248	5.65	6/262	2.29	-9/260	-3.46	2/186		4/183		5/192		6/208		9/210		10/218		3/167		7/173		5/185	
077	61 Bel air 8	10-24	60/575	10.43	5/575	0.87	-10/570	-1.75	20/300	6.67	3/302	0.99	-2/300	-0.67	0/191		2/198		2/209		1/212		1/219		2/220		0/183		1/192		1/203	
078	63 Rambler · 6 B	10-25	B/B												B/B												B/B					
079	63 Comet 8	10-26	62/700	8.86	48/762	6.84	40/685	5.84	15/380	3.95	10/400	2.50	23/409	5.62	-6/170		-3/177		-3/182		-3/210		-2/212		-1/216		-5/179		-3/182		-4/187	
080	64 County Squire 8 B	10-26	10/540	1.85	15/545	2.75	35/510	6.86	-15/362	-4.17	-5/370	-1.35	B/B		-4/201		-3/210		-4/215		-5/225		-2/232		B/B		-4/187		-4/197		-3/202	
081	64 Nova · 6	10-27	27/588	4.59	-3/605	-0.50	4/598	0.67	60/265	23.53	3/362	0.99	12/270	4.14	-4/169		-17/185		-6/191		-2/186		-4/193		-2/200		-6/166		-7/175		-2/185	
082	65 Electra 8	10-27	-8/668	-1.20	-21/683	-3.07	1/653	0.15	47/352	-13.35	-25/345	-7.25	-9/346	-2.60	-10/205		-10/217		-10/225		-1/213		1/223		-2/232		-9/195		-9/207		-8/215	
083	65 Galaxie 8	10-30	2/550	0.36	-5/565	-0.88	-11/563	-1.95	-7/312	-2.24	7/305	2.30	4/308	1.30	-8/183		-9/194		-14/204		-7/199		-7/209		-10/220		-8/178		-9/189		-13/199	
084	62 Cutlass 8 B	10-31	50/450	11.11	43/435	9.89	50/430	11.63	12/270	4.44	34/252	11.90	B/B		-9/217		-5/225		-5/232		-2/232		0/240		B/B		-12/210		-5/217		-3/223	
085	64 Chevy II · 6	11-2	12/640	18.75	-8/610	-1.31	0/612	0	2/315	0.63	-56/385	-14.55	22/278	7.91	-2/174		-10/185		-10/195		4/188		-3/196		-6/208		0/167		-8/178		-12/190	
086	60 Deville 8	11-2	47/418	11.24	5/425	1.18	60/390	15.38	23/202	11.39	25/210	11.90	-5/320	11.36	-3/175		-3/181		0/188		-2/194		-4/201		1/205		-3/165		-3/173		0/180	
087	63 Rambler · 6	11-6	30/530	-5.66	16/537	3.35	25/510	4.90	15/345	4.35	27/355	7.61	5/350	1.43	-1/171		-6/178		-3/181		-3/194		-2/198		-1/202		-3/161		-8/173		-4/178	
088	63 Custom 8 B	11-6	78/492	11.27	53/482	7.77	B/B		54/355	15.21	B/B		B/B		-1/197		3/209		B/B		-7/232		B/B		B/B		-7/190		3/202		B/B	
089	65 Rambler 6	11-6	51/608	9.38	46/600	7.00	1/639	0.16	0/370	0	5/370	1.35	12/361	3.33	-8/185		-5/192		-8/213		-5/208		-7/215		-6/223		-6/170		-5/178		-8/188	
090	64 Jetstar 88 8	11-7	48/593	8.11	81/572	14.16	62/580	10.69	-2/312	-0.64	28/302	9.27	20/310	6.45	-1/179		2/185		0/195		5/205		6/210		6/221		-1/171		3/177		0/187	
091	62 Galaxie 8	11-7	48/630	7.62	78/572	13.64	53/582	9.11	32/320	10.00	10/322	3.11	10/320	3.13	0/180		1/182		0/185		-1/208		3/212		0/218		-2/155		-7/177		1/176	
092	65 Lemans 8	11-10	18/482	3.73	50/479	10.44	58/460	12.61	7/224	-3.13	-1/229	-0.44	8/222	3.60	-4/190		0/197		-2/208		3/216		8/212		4/223		-4/184		-1/190		-2/200	
093	65 Monterey 8	11-10	85/725	13.60	60/740	9.38	60/610	9.84	24/316	7.59	5/310	1.61	41/294	13.95	2/173		0/181		1/185		2/200		1/208		-3/215		2/168		2/178		1/185	
094	59 Catalina 8	11-10	45/560	8.04	20/580	3.45	58/552	10.51	13/252	5.16	18/260	6.92	21/242	8.68	-5/189		-3/200		-3/211		-1/211		3/221		2/233		-4/194		-1/195		-2/206	
095	64 Newport 8	11-14	93/492	18.90	70/495	14.14	48/492	9.76	39/241	16.18	35/245	14.29	7/268	2.61	6/181		-2/189		0/187		6/197		1/208		1/208		0/135		6/151		-3/170	
096	63 Bisqueder 8	11-14	55/532	10.34	38/542	7.01	46/560	8.21	-1/256	-0.39	35/240	14.58	21/250	8.40	-5/180		-4/191		-5/203		-4/196		-4/216		-2/211		-7/174		-4/185		-5/198	
097	63 Galaxie 8B	11-15	8/472	1.69	B/B		6/B		5/B		6/B		6/B		-1/320		6/B		B/B		B/B		6/B		6/B		-15/319		6/B		6/B	
098	63 Chevy II · 6	11-15	50/660	7.58	-30/680	-4.41	-5/670	-0.75	90/290	31.03	10/330	3.03	33/300	10.67	-3/190		-2/200		-3/210		-1/201		-1/208		0/212		-7/185		-2/193		0/202	
099	63 Dart 6	11-17	20/702	2.85	85/640	13.28	84/626	13.42	-10/318	-3.14	-8/299	-2.68	-24/328	-7.32	-2/182		5/185		2/195		-4/203		4/206		2/215		-2/170		4/174		1/184	
100	64 Dart · 6	11-17	52/558	9.32	83/578	14.19	72/620	11.61	17/228	7.46	-5/240	-2.08	15/225	6.67	3/219		1/219		2/211		3/224		2/227		2/232		2/176		2/182		4/193	

ENTS:

PREPARED BY _____ ORGN. _____ DATE _____ SUBJECT TEMPERATURE DIFFERENTIALS _____ PAGE ___ OF ___

APPROVED BY _____ ORGN. _____ DATE _____ (WITH VAD - WITHOUT VAD / WITHOUT VAD)

	Water Out temp (Idle)			Water (In-Out) temp w/o VAD			OIL temp (Loaded)			OIL temp (Idle)			Exhaust temp (Loaded) Max Stow						Exhaust temp (Idle)					
	80°	90°	100°	80°	90°	100°	80°	90°	100°	80°	90°	100°	85°		90°		100°		80°		90°		100°	
	-1/206	8/214	B/223	20/16	19/17	19/20	-11/253	5/240	-2/270	-8/246	6/254	8/263	55/715	7.69	132/718	13.28	76/712	10.38	-2/490	4.08	26/510	3.92	- B	
	-3/192	0/197	-1/208	13/14	11/12	10/11	-7/236	-2/237	-7/245	-5/228	-3/231	-6/239	75/740	10.14	60/720	8.33	40/735	5.44	22/510	4.31	23/502	4.58	22/490	
	-13/184	-5/190	-1/202	9/8	7/8	7/7	3/250	-7/265	-7/271	-2/238	-5/243	-8/255	70/665	10.53	25/690	3.62	48/690	6.96	50/390	12.82	5/405	1.23	25/405	
	4/192	2/200	-3/208	15/14	16/15	16/5	-12/247	-5/255	-11/263	-9/234	-2/242	-7/249	20/538	3.72	35/535	6.54	42/530	7.92	90/315	28.57	30/340	8.82	25/350	
	-4/175	1/181	1/189	16/17	14/15	15/16	-9/232	-3/235	-5/237	-9/204	-4/226	4/228	25/715	3.50	25/710	3.52	35/730	4.79	-20/420	4.76	-10/420	-2.38	75/430	
	8/188	12/191	6/213	12/12	13/12	12/12	-1/240	2/241	-3/250	2/228	6/228	1/239	110/690	15.94	135/660	19.70	83/682	12.17	60/460	13.07	75/415	18.07	85/415	
	-7/210	-2/217	-2/223	25/10	22/20	15/16	-17/244	-3/248	-4/252	-18/235	-4/240	-5/242	55/690	7.97	65/670	9.70	42/620	6.18	-3/435	-0.69	-20/440	-4.55	5/420	
	5/212	12/204	11/213	13/12	10/7	7/7	1/225	4/227	3/238	3/215	7/217	7/227	104/760	14.86	114/694	16.43	110/700	15.71	63/390	16.15	95/399	23.81	95/395	
	1/198	1/206	0/213	8/8	6/7	6/7	-2/248	2/252	-2/260	-1/241	3/245	-3/253	70/692	10.12	5/685	0.73	-15/690	-2.17	34/405	8.64	0/400	0	10/390	
				B/B			B/B						B/B											
	-3/200	-2/212	-3/207	-5/-6	-5/-5	-5/-4	-5/212	-10/219	-8/223	-3/211	-7/217	-5/222	68/640	10.63	45/645	6.98	35/640	5.47	10/400	2.50	0/420	0	7/425	
	-4/214	-2/222	B/B	14/14	13/14	13/12	-9/267	-7/275	-7/277	-7/252	-7/262	B/B	50/740	6.76	25/745	3.36	52/708	7.34	10/460	2.17	-5/465	-1.08	B/B	
	-2/178	-2/185	-3/193	3/5	10/0	6/8	-7/200	-7/208	-10/216	-6/193	-5/200	-8/208	10/590	1.69	10/590	-1.69	13/632	2.23	10/400	2.50	20/405	4.94	36/394	
	-2/206	0/217	-3/225	10/9	10/9	10/8	-12/257	-8/267	-13/275	-12/248	-9/257	-10/264	10/890	1.45	-7/766	-0.99	10/681	1.47	3/443	0.45	9/433	2.08	18/440	
	-8/195	-7/205	-9/214	5/5	5/5	5/4	-15/242	-12/252	-19/260	-14/232	-12/241	-17/250	8/610	1.31	11/612	1.80	4/618	0.65	-3/471	-0.64	8/472	1.69	11/475	
	-6/226	0/234	B/B	7/10	8/8	9/7	-14/215	1/221	2/228	-19/234	-7/232	B/B	88/590	14.92	69/578	10.73	88/560	15.71	18/420	4.29	25/405	6.17	B/B	
	5/178	-3/187	-6/198	7/5	7/5	5/7	-8/205	-7/213	-10/222	-5/198	-6/207	-10/217	55/640	8.59	-13/665	-1.95	8/652	1.27	83/400	20.50	68/420	16.19	71/401	
	-3/181	-5/188	1/192	10/10	8/8	8/8	-8/225	-9/230	-6/235	-5/214	-8/221	-3/225	71/678	10.47	10/680	1.47	95/625	15.20	5/430	1.16	25/430	5.81	30/440	
	-4/189	-1/193	-2/197	10/12	5/7	3/4	-9/221	-2/225	-7/232	-10/212	-4/217	-7/225	42/778	5.40	38/782	4.86	53/762	6.96	1/520	0.19	10/530	1.92	10/515	
	-7/227	B/B	B/B	7/8	7/7	8/B	-11/268	1/277	B/B	-9/235	B/B	B/B	62/708	8.76	59/711	8.30	B/B		15/440	3.41	B/B		B/B	
	-4/195	-5/201	-7/211	15/13	14/14	15/15	-8/219	-5/225	-10/233	-8/214	-5/221	-8/228	-21/650	-3.23	-25/640	-3.91	13/602	2.16	5/440	1.14	2/450	0.44	0/455	
	5/195	5/202	5/212	8/8	8/7	8/8	0/235	1/240	-4/249	-5/222	-3/227	-2/237	64/628	10.19	99/610	16.23	78/622	12.54	33/375	8.80	45/365	12.33	50/378	
	-1/211	3/216	0/213	25/27	5/13	9/8	-12/245	-2/249	-3/263	-8/232	0/237	-3/241	51/669	7.62	72/650	11.08	75/640	11.72	10/480	2.08	17/480	3.54	20/480	
	1/200	7/205	2/217	6/6	7/8	8/8	-10/235	-1/239	-4/248	-7/225	0/230	-3/240	82/510	16.08	78/562	15.54	99/508	19.49	37/358	10.34	27/355	7.61	47/353	
	2/195	1/203	-1/210	5/5	3/1	0/0	-3/240	-1/246	-3/260	-2/227	-1/235	-1/238	100/830	12.05	85/845	10.06	82/820	10.00	18/532	3.38	0/540	0	28/532	
	-1/206	4/217	2/228	5/4	5/3	5/4	-17/260	-2/269	-6/278	-12/249	-1/257	0/265	60/680	8.82	42/700	6.00	83/672	12.35	28/402	6.97	28/412	6.80	30/400	
	7/173	0/190	1/190	46/52	38/30	17/20	-6/227	-1/230	-4/231	-5/223	-1/225	-2/226	103/745	15.97	105/640	16.41	70/645	10.85	23/435	5.29	20/440	4.55	18/437	
	-3/187	-3/197	-3/210	6/8	6/6	5/5	-11/226	0/230	-7/243	-8/218	-3/227	-7/240	65/635	10.40	59/650	9.08	72/660	10.91	6/430	1.40	28/432	6.48	17/443	
	B/B	B/B	B/B	11/9	B/B	B/B	-26/219	B/B	B/B	B/B	B/B	B/B	26/712	3.65	B/B		B/B		B/B		B/B		B/B	
	0/191	1/198	0/205	5/9	7/7	8/5	-1/212	1/217	1/227	-1/205	0/213	1/220	50/720	6.94	-12/720	-1.67	2/710	0.28	45/472	9.11	10/480	2.08	0/480	
	-3/190	3/194	1/203	12/12	11/12	11/12	-10/216	2/210	-4/220	-8/214	3/205	-3/217	-/975		-/880		-/905		5/525	0.95	4/508	0.79	-18/532	
	1/208	3/210	0/217	33/34	27/26	18/16	-3/220	2/223	0/233	-4/221	1/223	1/232	-/896		-/870		-/865		40/525	7.62	8/542	1.48	12/550	

SHEET – 27 COLUMN
1045 (R5-68)

CONTROLLED VEHICLES

SUBJECT TEMPERATURE DIFFERENTIALS
(WITH VAD – WITHOUT VAD) / WITHOUT VAD

PREPARED BY

APPROVED BY

FYING BER	DESCRIPTION	TEST DATE	Exhaust temp. (LOADED) Tail Pipe 80°F		90°		100°		Exhaust temp (IDLE) 80°		90°		100°		Water In temp (LOADED) 80°		90°		100°		Water In temp (IDLE) 80°		90°		100°		Water Out temp (LOADED) 80°		90°		100°		Wa 8
101	66 Impala 8	10-31	63/630	9.84	27/638	4.23	25/650	3.85	-2/362	-0.55	15/370	4.05	-13/395	-3.29	1/183		-2/190		-6/204		-6/208		-1/217		-1/231		-1/175		-2/182		-5/195		-5/193
102	66 Valiant 8	8-1	0/730	0	15/700	2.14	15/710	2.11	-10/470	-2.13	-20/510	-3.92	-10/500	-2.0	-7/190		-12/198		-11/208		-5/198		-8/206		-5/214		-8/178		-9/185		-9/196		-1/187
103	68 Impala 8	8-2	0/710	0	30/710	4.23	70/690	10.14	0/470	0.0	10/480	2.08	30/470	6.38	0/200		1/207		1/217		-2/215		0/220		0/228		0/192		2/201		0/213		-3/206
104	68 Chevelle 8	8-2	135/705	19.15	105/685	15.33	60/720	8.33	60/510	11.76	80/470	17.02	60/490	12.24	1/196		3/196		0/204		0/204		1/209		1/215		3/196		3/180		2/190		0/183
105	66 Cad. 8	8-4	150/710	21.13	60/770	7.79	115/815	14.11	50/480	10.42	50/510	9.80	45/525	8.57	-2/203		-2/214		-3/226		3/219		-1/229		-4/245		3/198		-1/205		-2/217		-5/208
106	70 Impala 8	8-9	60/615	9.76	55/610	9.02	65/685	11.11	45/420	10.71	40/420	9.52	10/415	2.41	-4/205		2/206		4/212		0/212		0/218		3/223		7/182		1/199		5/204		0/194
107	68 Dodge 8	8-3	-10/670	-1.49	70/600	11.67	20/625	3.20	30/410	7.32	45/390	11.54	30/390	7.69	-2/195		-4/200		0/208		-1/211		-1/218		-1/226		-3/190		-4/199		1/203		-1/200
108	68 Imperial 8	8-8	60/640	9.38	60/630	9.52	40/640	6.25	30/450	6.67	35/415	7.87	20/450	4.44	0/202		1/204		0/205		4/200		0/205		1/206		2/130		-1/149		-4/168		26/139
109	68 Camaro 6	8-7	130/445	29.21	100/460	21.74	100/470	21.28	65/300	21.67	50/315	15.87	55/310	17.74	5/159		4/170		2/178		7/187		3/200		3/204		6/150		4/161		1/169		7/17
110	70 Valiant 8	8-18	110/640	17.19	90/630	14.29	110/660	16.67	25/395	6.33	15/385	3.90	5/395	1.27	0/190		1/200		-2/202		3/207		3/213		2/219		2/180		2/184		0/186		2/18
111	69 Datsun 4	8-17	40/450	18.89	50/460	16.87	30/490	6.12	20/290	6.90	-5/355	-1.41	10/350	2.86	-4/174		-4/187		0/196		4/183		-2/206		10/210		-3/175		-2/187		3/194		-1/197
112	70 Ford 8	8-18	70/630	11.11	10/670	1.49	45/645	6.98	25/405	6.17	-15/425	-3.53	20/415	4.82	-2/197		-1/197		-2/198		-4/207		-5/217		-2/221		-2/178		-1/180		-2/185		-8/198
113	66 Ford 8	8-23	100/570	17.54	150/550	27.27	60/600	10.0	55/400	13.75	75/390	19.23	30/420	7.14	2/180		2/180		-1/184		4/193		-2/205		3/210		2/168		0/172		-1/176		5/156
114	67 Dodge 8	8-21	55/645	8.53	45/645	6.98	30/690	4.69	30/430	6.98	35/425	8.24	55/415	13.25	-2/188		-6/200		-2/208		6/222		-1/235		1/241		-2/178		-6/190		-2/188		-8/200
115	69 Chev 8	8-21	45/645	6.98	85/625	13.60	110/610	18.03	20/490	4.08	40/470	8.51	30/470	6.38	-1/191		+1/192		+1/194		0/184		1/198		0/198		-1/146		0/153		3/158		1/156
116	68 Plym 8	8-22	115/725	15.86	160/700	22.86	60/750	8.0	100/430	23.26	55/460	11.96	85/450	18.89	6/185		2/195		4/205		6/217		4/227		4/238		4/175		2/183		4/194		7/20
117	67 Plym 8	8-23	70/655	12.61	25/555	4.50	10/560	1.79	40/380	10.53	15/370	4.05	0/370	0	4/192		-2/196		0/203		4/221		-1/225		-2/234		1/184		-3/186		0/194		3/20
118	69 Camaro 8	8-24	145/500	29.0	125/530	23.58	145/475	30.53	70/370	18.92	50/395	12.66	50/370	13.51	0/194		-5/204		-4/209		10/204		-2/222		-1/229		2/175		-5/189		-3/195		+1/19
119	66 Plym 8	8-24	100/560	17.86	50/590	8.47	50/610	8.20	60/375	16.00	25/400	6.25	10/400	2.50	-4/195		0/197		2/207		-2/216		2/222		0/234		0/180		-1/188		-1/199		-1/56
120	67 Mustang 8	8-30	50/630	7.94	40/640	6.25	50/660	7.58	40/380	10.53	45/385	11.69	25/390	6.41	4/195		1/206		0/226		1/225		10/224		1/255		3/177		2/186		2/207		4/20
121	69 VW 4	8-24	-30/590	-5.08	20/580	3.70	0/550	.0	-30/430	-6.98	0/390	.0	10/390	2.56	—		—		—		—		—		—		1/191		2/200		8/207		8/20
122	67 Camaro 8 B	8-25	90/570	15.79	110/570	18.64	115/615	18.70	40/405	9.88	60/430	13.95	8/445		5/199		6/210		7/218		2/224		6/234		8/242		7/182		5/197		6/206		2/21
123	70 Mercury 8	8-26	100/550	18.18	70/580	12.07	20/560	3.57	75/380	19.74	55/400	13.75	0/400	0	7/192		0/186		3/186		7/218		-7/217		-4/224		-3/184		0/184		3/184		-8/20
124	67 T/B 8	8-28	110/580	18.97	110/610	18.03	80/680	11.76	60/406	15.0	50/420	11.90	35/435	8.05	5/178		-4/190		-6/197		7/200		-3/215		-7/220		5/175		-4/188		-10/194		8/19
125	69 Nova 8	8-29	125/645	19.38	90/660	13.64	80/670	11.94	80/430	18.60	35/460	7.61	50/480	10.42	-5/199		4/200		0/211		-1/220		5/225		3/236		-5/190		3/192		0/194		-1/21
126	69 Fury III 8	8-30	45/655	6.87	30/[illegible]	2.74	20/670	2.99	30/310	9.68	15/335	4.48	10/330	3.03	2/[illegible]		-3/216		-3/219		-3/216		-4/226		-2/236		0/196		-3/199		-2/204		[illegible]
127	68 GTO 8	9-1	-15/[illegible]	-240	19/[illegible]	38.0	—		20/340	5.88	—		—		1/201		2/[illegible]		-1/204		2/210		0/217		1/210		0/170		2/179		0/184		7/[illegible]
128	66 GTO 8 B	9-1	90/[illegible]	15.08	[illegible]		[illegible]		8/335		[illegible]				5/[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]
129	68 Ambassador 8	9-5	[illegible]	16.79	[illegible]	8.45	[illegible]	7.67	[illegible]	1.98	[illegible]	2.85	[illegible]	3.12	1/196		8/197		[illegible]		2/215		5/220		1/[illegible]		9/196		9/190		[illegible]		[illegible]
130	69 Cougar 8 B	9-5	[illegible]	2.44	15/[illegible]	3.57	73/[illegible]	17.30	35/[illegible]	12.96	8/8		8/8		-7/[illegible]		-15/[illegible]		-7/330		-1/[illegible]		1/[illegible]		[illegible]		[illegible]		-15/219		-5/240		-3/[illegible]
131	68 Cougar 8 B	9-6	-11/[illegible]	-2.11	[illegible]		[illegible]		-10/[illegible]	-3.03	[illegible]				9/[illegible]		[illegible]		[illegible]		4/[illegible]		[illegible]		[illegible]		7/99		8/[illegible]		[illegible]		5/[illegible]
132	68 LTD 8	9-7	35/470	4.89	2/489	1.43	-9/475	-1.89	10/340	2.94	-2/340	-5.88	-12/320	-3.59	-11/191		14/192		6/195		-2/209		2/213		-4/215		6/170		11/178		6/183		-2/19
133	66 Chevrolet 8	9-7	48/495	9.90	78/461	16.92	58/461	12.58	34/297	11.42	16/317	5.04	40/292	13.70	6/195		[illegible]		-2/214		12/216		-4/227		-4/237		16/172		-12/193		-2/213		2/[illegible]
134	68 F-85 Cutlass 8	9-8	71/402	17.40	37/400	21.75	64/379	18.21	25/312	8.17	35/316	9.81	8/292		2/[illegible]		[illegible]		16/219		8/228		11/233		8/243		13/177		13/187		16/199		4/[illegible]

MENTS:

RED BY Hc ORGN. DATE SUBJECT 8880-7002 PAGE OF

ED BY ORGN. DATE

	Water Out temp. (IDLE)			Water (In - Out) temp. w/o			Oil temp. (LOADED)			Oil temp. (IDLE)			EXHAUST TEMP (LOADED)						EXHAUST TEMP. (IDLE)					
	80°	90°	100°	80°	90°	100°	80°	90°	100°	80°	90°	100°	80°F		90°F		100°F		80°F		90°F		100°	
	-5/193	-1/214	-10/225	8/10	8/8	9/8	-2/242	-5/255	-14/271	-7/232	-3/240	-12/257	72/878	10.62	35/680	5.15	37/688	5.38	-6/548	-1.09	13/562	2.31	16/582	
	-1/187	-7/194	-4/203	12/13	13/10	12/10	-13/255	-11/256	-11/262	-11/244	-13/246	-13/250												
	-3/206	0/211	0/220	8/8	6/5	4/5	-8/250	0/254	-1/263	-4/236	-3/245	-2/254												
	0/183	0/194	1/201	20/18	16/16	14/12	4/238	0/239	-2/247	2/229	2/230	-1/238												
	-5/208	-2/219	-4/235	8/7	9/8	9/8	3/259	-10/275	-10/283	3/245	-4/257	-8/268												
	0/194	1/202	3/208	23/12	7/8	8/7	-2/250	0/252	2/256	-1/239	0/243	4/246	8/889	0.9	22/874	2.52	96/860	11.16	10/635	1.57	18/627	2.87	21/629	
	-1/200	-1/208	-1/217	5/6	5/5	5/4	-5/245	-5/250	-2/254	-4/234	-4/240	0/244												
	26/139	-5/167	5/187	72/70	55/55	37/41	0/229	-2/234	-2/236	0/220	0/224	-1/227												
	7/176	4/187	1/194	9/8	9/9	9/10	9/198	0/215	1/219	7/195	0/210	1/214												
	2/189	3/195	2/201	16/14	16/15	16/14	1/231	-1/235	-1/237	4/225	1/230	2/230												
	-1/197	6/200	11/204	1/2	0/2	5/2	0/209	-2/221	3/222	0/206	1/217	7/217												
	-6/198	-5/210	-2/214	19/19	17/17	13/13	-5/212	-14/222	-18/225	-5/210	-10/224	-6/227												
	5/186	0/196	2/205	12/12	8/10	6/6	-2/234	-1/235	-6/239	-1/220	0/225	-3/230												
	-8/200	-4/208	-3/228	10/10	10/10	10/10	-4/230	-9/240	0/245	0/225	-8/235	2/238	105/845	12.43	100/850	11.76	80/835	9.58	10/610	1.64	10/600	1.67	30/590	
	1/156	0/165	0/170	45/45	39/40	36/34	-5/223	-3/224	0/225	-1/211	0/214	0/217	60/730	8.22	105/700	15.0	120/700	17.14	15/630	2.38	40/600	6.67	0/630	
	7/204	5/215	3/229	10/12	12/12	11/11	14/208	6/224	-2/243	10/204	1/220	2/229												
	3/208	-1/212	0/221	8/11	10/11	9/9	3/235	-6/239	-4/245	4/236	-2/228	-1/236	90/860	10.47	50/785	6.37	65/715	8.39	-20/540	3.70	15/525	2.86	10/525	
	+1/199	-3/209	0/214	19/17	15/15	14/13	-3/247	-9/261	-3/261	2/234	-6/246	-1/247	90/660	13.64	95/660	14.39	105/660	15.91	55/610	9.02	120/565	21.24	70/635	
	-1/201	0/211	0/222	15/11	9/10	8/11	6/228	-4/239	1/244	10/213	-2/230	1/239	90/855	10.53	115/840	13.69	125/855	14.62	30/575	5.22	15/585	2.56	25/575	
	4/208	6/213	2/232	18/19	20/19	19/21	2/203	6/265	-8/240	7/214	4/227	0/231												
	8/204	7/209	6/220	90/88	90/92	90/92	1/246	-2/258	4/264	-1/231	0/240	5/245	25/610	4.10	30/630	4.76	20/645	3.10	20/465	4.30	15/475	3.16	-5/510	
	2/210	6/220	8/228	17/15	13/14	12/13	1/253	0/264	5/269	4/240	13/221	9/228	125/705	17.73	145/750	19.33	145/775	18.71	45/565	7.96	60/600	10.0	8/625	
	-8/209	-6/210	-4/218	8/4	2/2	2/2	-8/236	-5/232	-8/232	0/225	-1/225	0/225	60/810	7.41	60/790	7.59	65/780	8.33	0/580	0	5/565	0.88	0/570	
	8/191	-3/209	-6/215	3/3	2/2	3/7	5/227	-5/246	-5/247	5/216	-15/240	-8/236	118/882	13.38	106/894	11.86	105/895	11.73	28/590	4.75	35/585	5.98	10/585	
	-1/211	4/217	3/229	9/9	8/9	7/7	2/239	-2/249	0/257	3/231	1/240	1/249	190/800	23.75	60/870	6.90	90/895	10.06	35/545	6.42	20/555	3.60	25/465	
	1/196	-3/217	-1/214	5/7	7/9	5/4	6/246	-11/252	-3/255	-2/235	-7/247	-4/251	0/1000	0	22/978	2.25	35/965	3.63	-16/616	2.60	13/625	2.08	-67/635	
	7/116	2/186	0/197	31/32	23/23	19/18	2/253	-5/258	-1/257	1/237	1/246	1/242	20/950	-2.11	90/830	10.84	135/770	17.53	10/520	1.92	10/510	1.96	20/525	
	1/211	1/1	1/1	20/19	1/1	1/1	5/257	1/1	1/1	1/248	1/1	1/1												
	1/216	4/215	1/219	10/9	7/6	4/2	-3/245	1/246	-2/247	-2/235	2/236	-1/238												
	-3/219	1/1	1/1	5/6	8/5	-10/8	-10/208	-4/210	-1/214	-5/217	1/1	1/1	45/755	5.96	62/755	8.21	55/755	7.28	55/545	10.09	-8/8		8/8	
	5/217			8/10			4/233			3/235	1/1	1/1	10/925	1.38	8/8		8/8		-30/570	-5.26	8/8		8/8	
	-4/178	2/214	-2/217	21/10	4/7	2/4	8/184	7/195	1/200	-2/216	-7/211	1/215	80/740	10.81	93/750	12.40	81/752	10.77	10/626	1.61	-23/655	-3.51	-57/642	
	2/202	-4/214	-1/222	21/11	12/16	11/11	3/211	-7/224	2/232	4/223	-7/237	-1/243	62/744	8.33	56/732	7.65	69/719	9.60	48/562	8.54	-6/560	-1.07	25/547	
	9/216	13/222	8/232	21/10	17/9	10/10	8/237	1/249	1/247	5/237	5/243	8/246	95/555	17.12	46/608	7.57	75/505	14.85	16/466	3.43	43/451	9.53	8/460	

SHEET – 27 COLUMN
1043 (R5-65)

SUBJECT CONTROLLED VEHICLES.

PREPARED BY

APPROVED BY

TIFYING MBER	DESCRIPTION	TEST DATE	Exhaust temp (LOADED) 80°F		90°		100°		Exhaust temp (IDLE) 80°		90°		100°		Water In temp (LOADED) 80°		90°		100°		Water In temp (IDLE) 80°		90°		100°		Water Out temp (Loaded) 80°		90°		100°		Wa 8
135	66 Cutlass 8	9-8	63/480	14.38	83/478	17.00	76/480	14.58	53/322	11.46	41/320	12.91	51/330	15.45	4/181		0/192		11/200		4/209		0/222		9/220		5/172		0/184		9/193		5/199
136	66 S55 8	9-8	69/372	18.55	-6/445	-1.35	16/469	3.91	39/305	12.79	-15/360	-4.17	0/325	0	-14/212		0/205		1/211		-8/223		0/222		2/229		-23/198		1/184		3/193		-7/212
137	69 Ambassador 8	9-11	43/392	10.97	35/406	8.62	28/411	6.81	123/199	61.81	16/316	5.06	0/325	0	-11/207		-2/204		-1/212		-4/216		-13/220		-12/228		-13/194		-3/191		-1/200		-2/197
138	70 Cutlass 8	9-11	107/444	24.26	79/463	17.06	58/452	12.83	40/332	12.05	57/335	17.01	-43/355	-12.11	1/194		-1/195		0/197		-2/216		-11/215		2/217		1/173		1/176		0/183		-3/205
139	67 Tempest 8 4-dr	9-11	16/496	3.23	-34/519	-6.55	—/535		33/322	10.25	-31/403	-26.10	—/329		8/198		3/209		—/219		4/217		3/227		—/239		5/185		2/196		-/206		3/204
140	67 Chy 300 8	9-16	213/449	27.10	214/435	29.12	221/415	30.91	40/345	11.59	91/318	28.62	-205/540	-37.96	8/178		60/135		10/171		13/205		11/217		18/221		10/170		57/130		10/185		10/195
141	69 Squire Country 8	9-16	162/459	35.29	69/461	12.52	31/541	5.53	18/312	5.77	17/318	5.35	10/308	3.25	5/213		-6/225		-7/233		8/222		-7/240		-6/249		5/200		-6/211		-6/218		7/209
142	71 Custom 8	9-16	13/482	2.70	73/430	16.98	78/431	18.10	7/308	2.27	33/370	11.03	37/282	13.12	-5/197		0/192		3/191		4/215		0/219		0/221		-4/174		2/171		5/174		1/214
143	67 Cougar 8	9-13	49/636	7.70	32/657	4.87	60/635	9.45	19/382	4.97	18/388	4.64	46/400	11.50	-2/183		-5/196		-1/199		0/214		-4/229		-3/231		0/173		-4/186		-1/190		1/203
144	67 Biscayne 6	9-13	31/712	4.35	27/722	3.74	43/733	5.87	-15/383	-3.92	-1/376	-1.27	-31/441	-7.03	-3/190		-6/199		-5/209		-2/207		-3/213		-2/223		-4/182		-6/191		-4/201		-2/193
145	68 Dart 8	9-13	32/697	4.59	35/693	5.05	-19/691	-2.75	-14/403	-3.47	39/361	10.80	80/320	25.0	-6/196		-13/207		3/217		-1/208		-8/221		-1/221		-8/191		-13/202		-1/213		-2/198
146	69 Executive B	9-14	51/688	7.41	78/653	11.94	B/670		19/360	5.28	22/356	6.18	B/B		5/227		5/230		B/235		1/232		5/235		B/B		5/207		4/210		B/219		-1/217
147	68 Corona 4	9-14	70/593	11.80	-4/631	-0.63	67/613	11.11	9/296	3.04	10/324	3.09	23/350	6.57	-6/166		-2/171		-7/180		-4/183		0/192		-4/198		-7/157		-2/162		-8/173		-4/171
148	70 Impala	9-15	45/590	7.63	75/554	13.51	61/555	10.99	-5/340	-1.47	50/300	16.67	80/302	26.49	0/203		0/200		-11/216		2/210		3/218		-4/221		-1/198		2/185		4/187		5/190
149	68 Colony 8	9-18	18/615	2.71	38/652	5.83	43/672	6.40	-20/372	-5.38	2/368	5.43	45/360	12.50	0/197		-3/201		-1/207		2/218		-3/225		0/230		0/185		-3/190		-1/196		2/207
150	66 Electra 8	9-19	130/370	35.14	-28/382	7.33	2/380	0.53	-2/362	-0.66	12/310	3.87	-10/340	-2.94	6/197		-5/206		0/217		5/217		-1/213		-1/227		4/180		-4/187		15/198		1/194
151	69 Impala 8	9-20	70/642	10.90	43/655	6.56	92/638	14.42	33/342	9.65	-6/348	-1.72	30/335	8.96	2/175		-2/180		2/182		4/208		-1/211		3/214		0/180		-2/187		3/187		8/196
152	69 Malibu 8	9-20	109/548	19.89	114/555	20.54	89/552	16.12	2/370	0.54	13/361	3.60	25/347	7.20	3/191		3/193		3/197		5/202		4/206		4/210		7/161		7/168		5/178		5/185
153	66 Nova 8 B	9-21	72/690	10.43	72/680	10.59	B/		-10/520	-1.92	B/548		C/B		3/201		-10/217		B/B		-2/244		B/245		B/B		2/197		-10/213		B/B		-2/237
154	66 Mustang 6 B	9-22	354/623	56.82	339/641	52.89	318/632	50.32	115/337	34.12	138/351	39.43	B/359		24/190		29/193		25/205		26/224		36/225		B/240		-11/216		25/187		23/197		25/216
155	70 GTO 8	9-22	-47/626	-7.51	20/605	4.94	94/629	21.91	22/260	8.46	28/250	11.20	78/245	31.84	5/182		1/187		5/187		12/185		9/192		15/193		7/166		5/172		9/177		8/172
156	67 Riviera 8	9-25	31/419	6.47	17/485	3.51	20/492	4.07	22/280	7.86	8/284	2.82	-18/299	-6.02	-4/208		1/215		-3/224		-5/236		-1/244		6/245		-5/195		-1/203		-11/209		-5/215
157	69 Fury III 8	9-25	88/656	13.54	96/626	15.34	61/660	9.24	54/264	20.45	-79/269	-29.37	41/270	15.19	6/187		1/190		-11/201		2/213		2/217		-5/227		4/178		1/181		-6/193		4/200
158	69 Electra 8	9-26	66/643	10.26	52/648	8.02	58/632	9.18	8/365	2.19	52/360	14.44	40/342	11.70	2/201		0/207		0/205		1/226		-1/231		-2/234		1/191		0/196		-1/193		-1/[illegible]
159	67 Impala 8	9-26	130/765	16.99	93/785	12.10	86/814	10.57	48/441	10.88	66/435	15.17	21/489	4.29	2/194		-1/193		1/197		1/208		0/213		1/217		2/175		0/184		0/187		2/195
160	69 Newyorker 8	9-26	73/652	11.20	-37/615	6.02	93/607	15.32	33/298	11.07	31/299	10.37	35/305	11.48	-1/187		-2/191		-4/201		-2/212		-1/214		-1/223		-1/181		-1/184		-3/195		-1/198
161	68 Valiant 8	9-27	48/742	6.47	35/695	5.04	0/700	0	-9/319	-2.82	0/316	0	0/309	0	-4/202		16/200		-5/215		-2/220		-4/222		-3/224		-4/194		-4/193		-4/197		-3/205
162	66 Cutlass 8	9-27	58/581	9.98	72/580	12.41	73/582	12.54	27/329	9.34	25/325	8.77	11/316	3.55	1/183		2/185		4/192		1/220		1/223		1/226		-4/163		3/170		2/177		-10/200
163	68 Radett 4B	9-27	20/560	3.57	20/540	3.70	0/570	0	126/266	24.15	18/291	3.45	133/180	68.33	2/176		-3/185		-3/194		1/208		-3/215		0/223		2/183		-5/193		-3/201		5/211
164	67 Fairlane 8	9-28	58/550	10.55	40/550	7.27	40/570	6.78	10/303	3.30	-2/312	-0.66	4/348	1.15	-3/207		-3/199		-5/212		-3/226		-2/212		-13/231		-3/213		-4/191		-5/212		-2/214
165	69 Impala 8	9-28	92/620	14.84	80/628	12.74	81/618	13.11	4/331	1.21	36/320	11.88	37/312	11.86	3/202		2/206		-2/217		10/212		9/218		8/221		4/181		6/190		7/195		6/194
166	68 Mustang 8	9-29	189/615	28.42	141/690	21.30	133/675	19.70	40/350	11.43	50/330	15.15	32/338	9.47	7/174		7/181		3/194		9/215		6/214		7/225		9/163		7/172		3/185		8/197
167	69 Stang 4	11-14	50/400	12.50	60/408	14.71	70/340	17.95	2/148	1.01	-1/143	-0.52	18/200	9.00	1/176		-1/184		2/188		-1/193		-3/190		1/195		1/167		-1/171		2/183		2/172
168	68 Dodge 8	10-2	94/721	13.04	90/740	10.81	81/721	11.23	43/265	16.23	32/322	9.94	50/290	17.24	5/183		2/188		4/196		4/197		3/203		1/212		3/177		2/181		1/191		5/187

NTS:

BY _____ ORGN. _____ DATE _____ SUBJECT TEMPERATURE DIFFERENTIALS PAGE ___ OF ___ 8880-7002

BY _____ ORGN. _____ DATE _____ (WITH VAD - WITHOUT VAD / WITHOUT VAD)

Water Out temp (IDLE) 80°	90°	100°	Water (In-Out) temp. W/ WOR VAD 80°	90°	100°	Oil Temp (LOADED) 80°	90°	100°	Oil Temp (IDLE) 80°	90°	100°
5/199	-1/213	8/220	9/8	8/8	7/9	3/205	-4/239	4/243	4/217	-2/230	8/235
-7/212	0/212	2/220	14/23	21/20	18/16	-8/261	-3/259	-2/245	-9/252	-2/251	-1/255
-2/197	0/203	-2/214	13/15	13/14	12/12	-2/205	-9/212	7/219	-6/229	-4/231	-3/240
-3/215	-1/203	3/206	21/21	19/17	14/14	3/245	6/247	-3/248	5/232	-3/243	6/240
3/204	3/213	—/227	16/13	14/13	17/13	1/252	8/259	—/267	3/244	5/253	—/261
16/195	10/215	7/210	8/6	5/8	6/6	4/221	7/231	8/234	3/215	3/225	-16/225
7/209	-6/226	-5/236	13/13	14/14	15/14	9/238	-9/257	0/255	14/233	39/264	0/253
1/214	0/208	1/210	23/22	21/19	17/15	11/210	2/222	6/228	8/221	-2/231	3/232
1/203	-2/215	-3/220	10/8	10/9	9/9	-6/206	-3/221	2/227	-4/210	-6/223	-2/225
-2/193	-2/199	-3/209	8/9	8/8	8/7	-6/226	-9/241	-1/249	-5/220	-7/235	2/241
-2/198	-6/211	0/211	5/7	5/4	4/8	-6/220	-19/234	-9/241	-2/217	-9/232	-6/232
-1/214	2/220	0/B	20/20	20/21	16/B	4/266	1/270	B/274	0/258	5/259	B/B
-4/171	-2/182	-4/187	9/10	9/9	7/8	6/256	2/230	-5/240	-24/204	-1/215	-5/220
5/195	1/190	-5/202	15/16	15/13	27/14	-5/252	0/247	-3/250	6/240	6/240	0/240
-2/207	-2/214	-1/222	12/12	11/11	11/11	-3/250	-5/253	-2/258	6/242	-6/241	-4/253
1/194	0/200	-3/216	17/19	19/18	19/20	7/182	-3/190	0/202	6/197	-1/205	-2/218
8/196	-1/201	2/205	-5/-3	-7/-6	-5/-6	-3/243	-6/249	-3/245	-1/233	-6/235	0/234
5/185	6/189	4/199	30/26	25/21	19/17	1/246	3/248	-1/252	-2/237	5/237	0/242
-2/237	B/239	B/B	4/5	4/4	B/B	-13/252	-1/257	B/B	-1/248	B/253	B/B
25/216	-28/217	B/231	-26/9	6/10	8/10	4/201	0/195	32/202	12/201	-25/199	B/215
8/172	13/174	12/181	16/14	15/11	10/6	1/246	2/247	5/247	-3/240	4/236	-4/247
-5/215	0/212	-1/223	13/14	12/14	15/23	-17/271	-5/278	-6/281	-11/262	-3/259	-3/263
4/200	1/207	-6/216	9/11	9/11	8/3	-18/238	-13/249	-9/248	-3/227	0/231	-7/240
-1/206	1/211	4/214	10/11	11/11	12/11	-2/254	-2/258	-1/251	0/246	2/250	0/251
2/195	1/203	0/208	9/9	9/8	10/11	-3/245	-2/252	-2/255	-10/244	0/242	0/246
-1/198	0/201	-1/211	6/6	7/6	6/5	-10/233	-1/233	-7/243	-12/232	-7/232	-5/237
-3/208	-3/207	-5/213	8/8	7/7	8/7	-9/231	18/228	-2/232	-6/237	-1/236	-4/239
-10/200	1/203	8/206	20/25	15/14	15/17	-5/247	0/248	-2/255	-1/233	0/236	0/242
5/211	-1/218	-1/218	-7/-7	-8/-6	-7/-7	-1/204	-2/210	-5/221	-1/191	-1/201	-5/211
-2/214	-2/213	-11/227	0/0	1/2	0/0	-3/227	-8/223	-13/242	-4/224	-5/231	-11/235
0/194	9/215	7/219	21/20	16/12	12/11	2/248	4/252	4/252	3/245	6/248	4/248
8/197	7/215	7/215	11/9	9/9	9/9	-3/217	-6/230	0/232	2/201	7/213	1/226
2/172	-3/183	2/188	9/9	6/6	5/5	-1/194	-1/201	-1/207	-1/192	-1/198	2/203
5/187	3/192	2/201	6/8	7/7	5/8	2/239	2/246	-1/249	4/230	4/232	1/242

Exhaust Temp. (Loaded) Not Mon 80°F	90°F	100°F	Exhaust Temp (Idle) 80°F	90°F	100°F
87/683 12.74	122/678 17.99	25/675 3.70	-37/560 -6.61	17/505 3.40	45/505 8.91
20/941 2.38	24/754 2.81	70/823 8.51	0/630 0	6/653 6.92	35/633 5.53
83/843 9.85	73/796 1.24	65/795 8.18	12/570 2.11	12/574 2.09	13/582 2.23
121/624 19.52	108/645 16.74	44/634 7.57	-12/470 -2.77	34/430 7.76	-79/459 -17.2
47/733 6.41	45/730 6.16	—/795	59/470 12.55	25/498 9.04	—/510
111/751 14.78	127/730 17.40	96/717 13.39	29/525 5.52	40/520 7.69	20/521 3.84
54/748 7.22	70/764 9.28	44/753 5.84	0/585 0	6/604 1.99	20/610 3.28
15/820 1.83	50/905 1.37	61/792 7.70	-12/560 -2.14	-21/574 -3.48	5/623 0.80
44/878 5.01	76/854 8.90	17/870 1.95	-17/590 2.88	28/560 5.0	60/536 11.19
6/765 7.84	84/678 12.39	B/692	5/495 1.01	11/499 2.20	B/B
72/717 10.04	53/709 7.48	21/730 2.88	-25/650 -3.85	-10/882 -1.47	-7/889 -1.02
85/715 11.89	85/696 12.32	66/700 9.57	2/540 0.37	18/525 3.43	6/530 1.13
30/721 4.17	48/712 6.74	55/715 7.69	-8/460 -1.74	16/441 3.63	34/438 7.94
113/636 17.94	56/752 7.67	55/705 7.80	18/462 3.90	22/476 4.60	0/520 0
106/815 13.01	73/825 8.85	121/799 15.14	37/601 6.16	8/600 1.33	33/582 5.67
98/634 15.46	156/639 24.30	99/629 15.74	25/542 4.61	47/520 9.04	31/533 5.82
58/800 7.25	62/788 7.87	B/B	-10/595 -2.53	8/418	B/B
—/994	—/983	—/967	82/645 12.71	112/648 17.28	B/667
21/599 3.51	105/567 18.52	153/600 25.50	30/425 7.06	27/425 6.35	42/430 9.77
48/781 6.15	57/778 7.33	50/800 6.25	18/532 3.38	21/530 3.96	-14/562 -2.49
104/771 13.49	103/749 13.75	100/765 13.07	67/504 13.29	34/528 4.55	36/532 6.77
83/756 10.98	121/719 16.83	75/755 9.93	8/542 1.48	50/549 9.11	39/540 7.22
144/752 19.13	110/776 14.21	109/781 13.96	42/600 7.0	44/610 7.21	40/629 6.36
91/759 12.65	62/720 8.61	84/725 11.59	41/559 7.33	21/559 3.76	25/565 4.42
59/719 8.42	51/778 5.81	19/882 2.15	0/462 0	3/462 0.43	5/461 1.08
83/588 13.95	81/556 14.73	102/558 18.28	35/435 6.90	17/438 3.97	36/420 8.57
59/780 7.56	40/775 5.16	67/791 8.59	27/524 5.14	21/599 3.83	-46/646 -7.25
59/671 8.79	41/662 6.95	22/677 3.15	0/562 0	3/485 1.62	22/560 3.93
-26/740 -3.51	-12/732 -1.64	72/728 12.42	80/480 16.67	80/472 16.95	34/455 7.47
234/747 31.51	222/768 21.30	172/767 22.56	42/600 7.17	52/592 8.46	29/600 4.83
60/640 9.38	39/639 6.10	58/650 8.92	13/390 3.33	-2/458 -0.44	70/430 16.28
90/889 10.12	95/900 10.56	93/869 10.70	30/505 5.94	-20/550 -3.64	55/520 10.58

SHEET – 27 COLUMN
1043 (R5-65)

SUBJECT CONTROLLED VEHICLES

PREPARED B

APPROVED B

IFYING BER	DESCRIPTION	TEST DATE	Exhaust Temp (Loaded) 80°F		90°		100°		T.P.	Exhaust temp (Idle) 80°		90°		100°		T.P.	Water In temp. (Loaded) 80°		90°		100°		Water In Temp (Idle) 80°		90°		100°		Water Out temp (Loaded) 80°		90°		100°		Wa 8
169	70 Toyota · 4	10-3								27/295	·9.15	2/332	·6.60	19/310	·6.13		-2/171	·	0/172	·	2/177	·	-2/183	·	1/185	·	-3/190	·	-3/156	·	0/161	·	-4/169	·	-6/173
170	71 Datsun · 4	10-3								53/220	·24.09	-5/252	-1.98	14/263	·5.32		1/182	·	-2/187	·	0/193	·	1/196	·	0/203	·	1/209	·	-11/145	·	-9/215	·	7/143	·	-2/177
171	70 Ford 8	10-3								1/407	0.25	-5/405	-1.23	-1/408	-0.25		0/207	·	-2/215	·	-5/217	·	4/212	·	0/221	·	0/225	·	5/193	·	0/205	·	-2/207	·	3/201
172	67 Toyota · 4	10-5	65/436	·14.91	42/432	·9.72	60/385	·15.19		0/260	·0	40/252	·15.87	20/232	·8.62		0/176	·	12/186	·	3/195	·	6/203	·	13/204	·	3/223	·	-1/173	·	12/185	·	2/195	·	6/197
173	69 Ford 8	10-5	74/550	11.38	47/624	7.53	50/630	7.94		8/354	2.26	11/339	3.24	23/340	6.76		1/194	·	0/193	·	1/203	·	1/234	·	3/234	·	-1/244	·	-2/190	·	9/192	·	-1/204	·	2/215
174	67 T-bird 8	10-6	-9/667	-1.35	78/645	12.25	39/706	5.52		31/414	7.49	67/395	16.96	63/405	15.56		-6/199	·	-8/211	·	3/199	·	0/223	·	0/233	·	1/236	·	-9/193	·	-3/199	·	-13/181	·	-2/215
175	66 Mustang 6	10-6	14/330	4.24	10/325	3.08	10/332	3.01		-3/216	-1.39	2/230	0.87	2/240	0.83		5/187	·	1/197	·	-2/210	·	3/220	·	5/226	·	-1/238	·	4/175	·	2/185	·	-2/198	·	2/205
176	67 Cutlass 8	10-6	75/600	12.50	108/572	18.88	71/622	11.41		5/335	1.49	17/323	5.26	20/360	5.56		-7/194	·	-12/208	·	2/208	·	2/215	·	-5/229	·	3/235	·	-5/188	·	-7/201	·	2/205	·	3/208
177	66 Ford 8	10-9	93/527	17.65	59/550	10.73	88/562	15.66		36/321	11.21	21/343	6.12	30/353	8.50		1/187	·	-1/193	·	2/194	·	3/210	·	1/217	·	6/218	·	2/163	·	4/172	·	3/181	·	2/221
178	70 VW Sedan · 4	10-10	231/529	42.86	191/524	·36.45	178/535	·31.78		79/349	22.64	78/352	22.16	35/370	·9.46		-3/106	·	2/119	·	-1/124	·	-1/111	·	3/118	·	1/121	·	1/251	·	7/260	·	2/267	·	0/245
179	68 Ventura 8	10-24	44/145	6.82	80/650	12.31	70/650	10.77		56/340	14.71	28/350	8.00	45/340	13.24		0/197	·	3/200	·	2/207	·	-1/212	·	5/217	·	2/225	·	-3/188	·	3/191	·	2/199	·	-3/202
180	69 Monaco 8	10-25	48/692	6.94	30/700	4.29	30/680	4.41		30/300	10.00	-15/340	-4.41	38/312	12.18		-1/194	·	-4/200	·	-4/200	·	-3/208	·	-3/215	·	-2/217	·	-2/185	·	-4/190	·	-4/190	·	-2/193
181	69 Olds 98 8	10-26	82/660	13.67	105/660	16.94	100/610	16.39		40/370	14.81	30/385	10.53	60/370	22.22		2/193	·	6/194	·	6/212	·	2/214	·	8/217	·	5/228	·	1/177	·	5/183	·	5/192	·	2/203
182	68 Riviera 8	10-26	50/420	11.90	15/415	3.61	25/430	5.81		10/230	4.35	18/220	8.18	20/240	8.33		-2/198	·	-4/207	·	-1/211	·	-1/221	·	-3/228	·	1/234	·	-1/188	·	-4/197	·	0/201	·	-2/205
183	67 Nova II 8	10-27	93/580	15.86	87/575	15.13	63/602	10.47		40/305	13.11	33/312	10.58	30/350	8.57		2/184	·	3/190	·	0/250	·	0/210	·	-3/216	·	0/223	·	0/171	·	4/178	·	0/189	·	-2/199
184	66 Corona · 4 B	10-30	63/882	·9.24	70/685	·10.22	B/B	·		58/240	·24.17	15/270	·5.56	B/B	·		-3/175	·	-2/185	·	B/B	·	5/192	·	2/197	·	B/B	·	-2/165	·	-3/175	·	B/B	·	4/184
185	70 Lemans 8	10-30	80/700	11.43	81/691	11.72	102/698	14.61		49/380	12.89	5/410	1.22	45/385	11.69		0/197	·	3/201	·	3/212	·	3/207	·	8/212	·	5/224	·	0/187	·	4/190	·	3/201	·	3/192
186	70 LaSabre 8	10-31	51/491	10.39	51/480	10.63	80/470	17.02		3/372	1.10	18/362	6.87	48/242	19.83		4/227	·	3/230	·	4/237	·	6/239	·	1/244	·	0/262	·	-4/176	·	5/180	·	2/197	·	8/167
187	69 Corona · 4	11-1	97/545	·17.80	53/552	·9.60	73/662	·12.13		15/245	·6.12	15/250	·6.00	-15/332	-4.52		2/182	·	-1/184	·	-2/195	·	-3/190	·	-1/193	·	-1/198	·	2/163	·	0/170	·	-3/197	·	-3/180
188	70 Fury II 8 B	11-1	145/705	20.57	141/696	20.26	151/694	23.25		48/350	13.71	34/330	10.30	B/332			3/189	·	7/192	·	7/205	·	3/217	·	12/222	·	B/239	·	3/179	·	9/183	·	6/197	·	3/203
189	66 Deville 8	11-1	45/520	8.65	18/522	3.45	10/560	1.79		18/269	6.69	9/273	3.30	67/245	27.35		-1/175	·	-1/176	·	-1/184	·	-2/202	·	2/203	·	-2/216	·	-4/158	·	-4/165	·	0/175	·	0/192
190	70 Cougar 8	11-2	105/590	17.80	72/608	11.46	74/636	11.64		15/345	4.35	40/380	10.53	23/387	5.94		-1/182	·	1/185	·	-1/189	·	4/212	·	3/217	·	0/225	·	2/171	·	2/178	·	1/186	·	3/204
191	68 County 8	11-3	87/595	14.62	30/618	4.85	40/662	6.64		85/275	30.91	2/348	0.57	15/355	4.23		-1/207	·	-3/210	·	-2/215	·	1/220	·	-1/222	·	-1/226	·	0/195	·	-4/200	·	-3/214	·	3/208
192	69 Galaxie 8	11-3	70/640	10.94	78/622	12.54	46/642	7.17		12/348	3.45	22/330	6.67	15/335	4.48		0/191	·	2/195	·	-5/207	·	3/211	·	2/218	·	-2/232	·	0/179	·	1/182	·	-4/192	·	3/193
193	68 Tempest 6	11-7	112/800	14.00	130/755	17.22	70/780	8.97		45/405	10.59	45/410	10.98	50/405	12.35		4/260	·	12/264	·	6/216	·	1/225	·	8/227	·	1/236	·	7/176	·	11/178	·	0/195	·	2/210
194	68 Coronet 8	11-8	92/690	13.33	40/700	5.71	79/666	11.86		10/320	3.13	44/278	15.83	2/330	0.61		3/183	·	0/190	·	2/195	·	0/210	·	9/211	·	1/224	·	2/173	·	0/180	·	2/186	·	-1/196
195	69 Cougar 8	11-9	60/730	8.22	5/730	0.68	59/672	8.78		-20/330	-6.06	20/300	6.67	-15/350	-4.29		-6/218	·	-12/223	·	-3/221	·	-8/236	·	-12/244	·	-2/242	·	-5/192	·	-9/198	·	-2/199	·	-1/208
196	67 Comet 8	11-9	122/630	19.37	175/615	28.46	168/600	26.67		135/315	+2.86	60/330	18.18	35/340	10.29		12/171	·	6/181	·	5/190	·	10/199	·	14/203	·	19/211	·	2/165	·	5/175	·	3/185	·	2/192
197	66 Fairlane 8	11-13	86/560	11.61	43/572	7.52	3/609	0.49		25/300	8.33	10/322	3.11	25/310	8.06		7/168	·	0/181	·	-6/198	·	-3/200	·	-1/204	·	-4/214	·	-1/150	·	12/165	·	-5/183	·	-14/191
198	68 Javelin 8	11-13	33/555	5.95	42/568	7.39	45/545	8.26		10/280	3.57	43/290	14.83	-43/320	-15.00		4/178	·	0/182	·	-14/197	·	5/199	·	1/203	·	2/207	·	3/160	·	0/168	·	-14/188	·	5/188
199	69 Dat 510 · 4	11-17	39/590	-5.93	-20/590	-3.39	-10/595	-1.68		22/300	·7.33	12/298	·4.03	8/290	·2.76		-10/190	·	-6/172	·	-8/182	·	-3/178	·	0/180	·	-3/183	·	-13/188	·	-5/168	·	-8/178	·	-4/172
200	69 Mustang 8	11-17	62/630	9.84	33/632	5.22	38/610	6.23		22/308	7.14	10/290	3.45	10/290	3.45		3/188	·	1/194	·	7/198	·	2/206	·	10/212	·	5/215	·	6/172	·	0/185	·	8/188	·	1/195

REPARED BY _____ ORGN. _____ DATE _____ SUBJECT TEMPERATURE DIFFERENTIALS (WITH VAD - WITHOUT VAD / WITHOUT VAD) PAGE ___ OF ___

PPROVED BY _____ ORGN. _____ DATE _____

)	Water Out temp (Idle) 80°	90°	100°	Water (In-Out) Temp w/o/w VAD 80°	90°	100°	OIL Temp (LOADED) 80°	90°	100°	Oil temp (Idle) 80°	90°	100°	Exhaust temp. (Loaded) hatriser 80°	90°	100°	Exhaust Temp (Idle) 80°	90°	100°
	-6/173	1/176	-5/183	15/6	11/11	6/12	-2/147	-1/156	-3/163	-3/189	-3/197	-5/201						
	-2/177	2/178	4/184	37/39	42/49	50/43	0/208	-4/216	3/218	3/204	-3/213	2/219						
	3/201	-1/211	-1/216	14/9	10/8	10/7	0/230	-3/246	-2/246	1/229	-3/235	1/235						
	6/197	13/199	3/218	3/4	1/1	0/1	20/162	1/195	0/207	10/195	2/208	1/216	92/588	15.65	68/622	10.93	96/604	15.89
	2/215	3/218	-1/232	4/7	1/1	0/1	-6/280	-2/280	-5/290	4/271	-3/271	-3/279	104/717	14.50	60/691	8.68	65/695	9.35
	-2/215	2/222	2/228	6/9	12/6	18/8	-13/260	6/252	-4/260	-7/247	-3/251	-2/249	39/866	4.50	107/865	12.37	—/927	
	0/205	4/211	0/222	12/13	12/11	12/12	3/230	-2/238	-2/245	4/225	3/232	8/244	8/862	0.93	84/890	9.44	73/877	8.32
	3/208	4/221	5/227	6/4	7/2	3/3	-1/237	3/250	1/258	1/227	7/244	3/250						
	2/201	2/208	5/209	24/23	21/16	13/12	0/237	1/240	-1/247	0/230	0/233	0/237	114/718	15.88	98/760	12.89	118/770	15.32
	0/245	5/250	3/257	-145/149	-141/146	-143/146	0/240	7/245	-3/259	-5/233	8/237	-1/246	—/889	.	—/870	.	—/905	.
	-3/202	5/207	3/214	9/12	9/9	8/8	-5/250	3/252	-2/262	-5/245	3/247	0/255	24/705	3.40	85/690	12.32	80/685	11.68
	-2/193	-4/200	1/210	9/10	10/10	10/10	-12/242	-6/247	-7/247	-17/232	-4/237	-4/238	62/830	7.47	48/832	5.77	45/825	5.45
	2/203	6/207	3/218	16/17	11/12	10/11	-4/241	1/242	0/250	-2/232	5/232	2/242	103/665	15.49	122/678	17.99	125/665	18.80
	-2/205	-2/210	1/217	10/10	10/10	10/10	-7/259	-15/263	-5/271	-5/248	-7/255	-2/260	78/820	9.49	35/820	4.27	42/838	5.01
	-2/199	3/205	0/213	13/15	12/11	11/11	-7/230	2/233	-3/242	-3/221	2/226	-3/235	95/605	15.70	89/598	14.88	65/615	10.57
	4/184	-1/188	B/B	10/9	10/11	B/B	0/185	3/189	B/B	-2/183	0/188	B/B	75/772	9.72	85/785	10.83	B/B	.
	3/192	7/198	4/211	10/10	11/10	11/11	-4/243	2/246	-2/259	0/237	5/240	1/252	105/810	12.96	103/817	12.61	112/828	13.53
	8/169	3/177	1/197	51/59	50/48	40/42	-8/265	-2/267	-3/274	-4/257	0/262	-2/269	83/585	14.19	61/580	10.52	73/582	12.54
	-3/180	-1/183	0/187	19/19	14/13	8/8	-6/197	-2/202	-6/218	-3/203	-1/206	-7/220	129/741	17.41	80/750	10.67	98/772	12.69
	3/203	10/208	B/226	10/10	9/7	8/9	-2/234	7/236	4/250	1/227	8/230	B/245	—/900		—/890		—/878	
	0/192	1/194	-3/201	17/20	11/14	9/8	-4/237	-8/238	-4/242	-3/227	-5/227	-4/234	65/710	9.15	48/692	6.94	80/700	11.43
	3/204	1/210	0/218	11/8	7/6	3/3	-5/239	-2/242	-2/247	-3/231	1/233	-2/240	105/845	16.28	80/645	12.40	84/656	12.80
	3/208	-8/210	-2/215	12/11	10/11	11/11	-9/264	-7/268	-6/269	-7/250	-9/255	-6/257	72/698	10.32	50/700	7.14	58/682	8.50
	3/193	1/202	-4/217	12/12	13/14	15/14	-7/236	1/240	-9/254	-5/222	1/228	-7/242	95/705	13.48	100/680	14.71	67/698	9.60
	1/210	7/211	2/220	24/21	26/25	21/21	-1/239	8/240	-3/253	1/225	9/237	0/248	120/872	13.76	123/855	14.39	92/858	10.72
	-1/196	12/197	1/212	10/11	10/10	9/9	-3/272	-3/278	-1/283	0/220	-1/226	2/230	123/825	14.91	30/860	3.49	95/800	11.88
	-7/208	-11/218	2/215	26/25	25/22	22/21	-17/292	-18/296	-9/289	-14/277	-15/281	-7/277	106/722	14.68	10/720	1.39	52/680	7.65
	2/192	14/195	19/202	6/16	6/7	5/9	1/217	3/224	0/234	2/213	7/220	4/231	159/838	18.97	160/840	19.05	160/840	19.05
	-14/191	-3/190	-2/197	18/26	16/4	15/14	-6/216	-2/219	-12/237	-4/210	0/213	-7/227	35/680	5.15	45/660	6.82	10/695	1.44
	5/188	0/195	3/197	18/19	14/14	9/9	3/234	-3/236	2/233	4/223	-1/226	0/227	78/670	11.64	67/668	10.03	65/655	9.92
	-4/172	0/175	-3/178	2/5	4/3	4/4	-5/215	-5/210	-12/220	-5/205	-5/215	-9/210	-53/530	-10.38	25/485	5.15	18/502	3.59
	1/195	12/190	5/205	16/13	9/10	10/10	3/184	1/194	6/199	7/205	11/204	10/211	70/670	10.45	45/680	6.62	60/660	9.09

	Exhaust Temp (Idle) 80°		90°		100°	
	-7/492	-1.42	4/488	0.82	14/476	[illegible]
	-5/498	-1.00	7/480	1.46	13/477	2.7
	5/627	0.80	51/560	9.11	52/576	9.0
	25/630	3.97	5/505	0.71	-10/753	-1.
	23/584	3.94	44/590	7.46	34/590	5.7
	1/519	0.19	19/531	3.58	-24/550	-3.
	25/520	4.81	10/530	1.89	18/530	3.
	25/460	4.46	0/515	0	30/560	5.
	30/500	6.00	25/505	4.95	40/490	8.
	15/550	2.73	15/550	2.73	10/560	1.
	15/470	3.19	17/475	3.58	15/480	3.
	27/412	6.55	-14/469	-2.99	B/B	.
	50/420	11.90	20/440	4.55	39/430	9.
	9/425	2.12	5/425	1.18	3/437	0.
	30/530	5.66	1/535	0.19	17/585	-2.
	37/635	5.83	22/610	3.61	B/605	
	15/455	3.30	-3/458	-0.66	0/450	0
	22/488	4.51	25/495	5.05	13/495	2.
	18/482	3.73	0/500	0	10/510	1.
	10/515	1.94	18/510	3.53	15/505	2.
	23/622	3.70	30/610	4.92	18/610	2.
	25/570	4.39	15/525	2.86	25/530	4.
	-17/522	-3.26	20/480	4.17	1/499	0.
	130/530	24.53	142/538	26.39	65/550	11.
	-7/510	-1.37	21/509	4.13	10/510	1.
	15/460	3.26	10/465	2.15	3/482	0.
	5/420	1.19	5/420	1.19	0/410	.
	0/510	0	0/502	0	20/500	4.

APPENDIX E

VEHICLE INFORMATION DATA

WORK SHEET – 27 COLUMN
FORM 1049 (R5-68)

PREPARED BY _____ ORGN. _____ DATE _____ SUBJECT 8880 - 7002 PAGE ___ OF ___

APPROVED BY _____ ORGN. _____ DATE _____ Vehicle Information (UNCONTROLLED VEHICLES)

IDENTIFYING NUMBER	TEST DATE	CAR DESCRIPTION	CID	A/C	ODOM.	Inertia	HP @ 50 MPH	Grade HP	Total HP	ENGINE RPM IDLE	ENGINE RPM W/O VAD	ENGINE RPM W/VAD	TIMING IDLE	TIMING W/O VAD	TIMING W/VAD	MANIFOLD VACUUM IDLE	MANIFOLD VACUUM W/O VAD	MANIFOLD VACUUM W/VAD	DISTRI. VACUUM IDLE	DISTRI. VACUUM W/O VAD	DISTRI. VACUUM W/VAD	Radio. Cap Pressure	Inspection Adjustment *	Comment
001	11-8	63 Valiant 6	225	0		3000	10.3	6.5	16.8/12	550N	2200	2200	2.5B	35B	22B	19.0	13.5	13.5	0.5	12.5	12.5	11		# 300 Gas
002	7-31	63 Valiant 6	225	0	067927	3000	10.3	17.3	27.6/23.0	550N	2200	2200	2.5B	30.5B	17.5B	20	12	10	2.0	12.5	10.5	14	O, Ti, E.	New Tail pipe
003	7-31	65 Impala 8	327	1	084524	4000	12.0	10.1	22.1/18.0	500D A/C on	2200	2200	4.0B	38.0B	22.5B	18	17	16	18	18	17	17	O, Tr, E	Patch Exh.
004	8-2	65 Mustang 8	289	1	069117	3000	10.3	12.4	22.7/18.5	500D/550	2100	2100	6.0B	41.0B	16.0B	18.5	16.5	15.	0	19.5	15	14		would not idle w/ A/C & HOLTES ON
005	8-4	64 Rambler 8	287	0	065819	3500	11.2	9.3	20.5/16.5	500D	2100	2100	8.0B	38.0B	21.0B	19.5	15	15	1.0	15.5	15.5	13		
006	8-14	65 Mustang 6	200	0	073155	2750	9.9	6.8	16.7/13.0	525D	2250	2250	12.0B	60 B	35 B	16.5	13.5	13.5	0.5	13.8	13.8	14	Tr	Timing off 20, Vac Leak, Tr. Oil Like
007	8-4	64 Buick 8	300	0	083149	3500	11.2	14.2	25.4/21	550D	2000	2000	2.5B/5.0	35 B	20 B	18.5	14.5	14.0	20.0	16	16	14	F.	New Fuel hose; New Vac. Adv.
008	8-8	60 T-bird 8	352	0	058185	4000	12.0	21.0	33.0/28	475D	2000	2000	6.0B	28 B	14B	18	16.0	16	0.5	13	13	13	C	
009	8-16	64 Olds 8	330	1	041307	3500	11.2	7.0	18.2/14.1	550D A/C off	2000	2000	7.5B	38B	18B	19.5	16.0	16.0	19.5	16.0	16.0	15	C	
010	8-17	63 Chry 8	413	1	122388	4500	12.7	27.8	40.5/35.0	500N A/C on	1800	1800	10 B	19.B	7.5 B	18	12.0	12.0	7.0	12.0	12.0	16	Tr.	Power Strg Brkt Brkn
011	8-17	65 Olds 8	425	1	103938	4500	12.7	10.5	23.2/19.0	550D A/C on	1900	1900	5 B	38B	21.B	20.5	14.5	14.5	12.5	14.5	14.5	14	C, F	New Vac. Adv
012	8-16	61 Falcon 6	144	0	073667	2500	9.4	7.8	17.2/13.5	525N	2350	2350	4.0B	37.B	6 B	18	12	12.	0	11.5	11.5	7	C, E	tightened Exh pipe @ manifold
013	8-18	63 T-bird 8	390	1	079145	4500	12.7	10.9	23.6/19.4	500D A/C on	1950	1950	8.0B	27.5B	11 B	18/18.5	16.5	15.5	0	16.0	15.0	14		New Vac Adv.
014	8-21	63 Dodge 6	170	1	069424	2750	9.9	7.3	17.2/13.5	550N	2050	2050	2.5B	26.5B	15 B	19.5	15.0	14.0	3.0	14.8	12.8	14	O, F	A/C belt not connected
015	8-22	64 Dodge 6	225	0	093592	3000	10.3	18.8	29.1/24.5	550N	2100	2100	2.5B	37.5B	17.6B	19.5	11.0	10.0	0	11.0	10.0	12 OLI	O, F	OLI Cap.
016	8-25	64 Falcon 8	260	0	083086	3000	10.3	9.7	20.0/16.0	500D	2200	2200	10B	38B	20B	18	15	14.5	0	15.5		13	F	# 300 Gas
B 017	8-28	65 Galaxie 8	390	1	085655	4000	12.0	24.7	36.7/31.5	500D A/C ON	1900	1900	6 B	28B	13B	21	14	13.5	15	14		13 OLI	C, Tr Ti	OLI Cap, 2 QT Tr.
018	8-28	64 Olds 8	330	1	101411	3500	11.2	12.0	23.2/19.0	550D A/C OFF	2100	2100	7.5B	44B	25B	21	16	16.5	21	15.5		13		
019	8-29	60 Impala 8	283	0	071540	4000	12.0	4.7	16.7/13.0	450D	2000	2000	4.0B	31.0	17.5	20	16.5	15.0	20	16.5	15.0	13 OLI		OLI Cap.
020	8-31	64 Ford 8	289	1	065838	3500	11.2	5.5	16.7/8.0	500D	2150	2150	10.B	38B	16B	18.5	14.2	15.4	0	16.4	15.0	13 OLI		OLI Cap
022	8-31	65 Malibu 8	283	1	052216	3500	11.2	11.6	22.8/18.6	475D A/C off	2150	2200	4 B	31 B	17B	18.5	14.6	14.3	18.5	15.3	14.6	14 OLI		OLI Cap
021	9-1	63 Buick 8	425	1	095680	4500	12.7	17.6	30.3/25.5	550D A/C off	2200	2150	12B	36B	24B	19.5	15.0	15.0	7.0	16.2		12	E, F	# 300 Gas, Make Tail pipe
023	8-31	65 Chev 6	230	0	050913	3500	11.2	11.5	22.7/18.5	475D	2150	2100	4 B	44B	26B	18.0	11.8	11.8	5.0	13.2	13.0	12	E, E	Coloring fuel [illegible]
024	9-5	65 Pont 8	326	0	073573	3500	11.2	5.0	16.2/12.5	500D	1800	1800	6B	37B	22B	19.5	17.5	15.0	18	15.5	0	14 OLI	Be, F, Tr, C, O	1 Gt Oil, 1 pt Tr. [illegible]
025	9-6	65 Mercury 8	390	0	074487	4500	12.7	33.0	45.7/40	500D	2100	2100	6B	30B	19.0	19.5	10.0	10.0	0	11.0		13 OLI	C	
026	9-6	62 Tempest 4	195	0	093738	3000	10.3	5.4	15.7/12.0	600D	2000	1950	6B	36B	14B	19.5	14.2	14.2	19.5	14		14		
027	9-7	65 Chevelle 6	230	0	062021	3000	10.3	5.4	15.7/12.0	500N	2000	1950	4B	43.5B	22B	16.0	14	13.2	0.5	15		13 OLI	C, E, F	Remv Trans Idle rpm [illegible]
028	9-14	64 Mercury 8	390	0	095981	4500	12.7	11.8	24.5/20.2	500D	2200	2200	10.B	35.5	17.5B	17	14.6	13.8	3.5	15.0	14.2	13 OLI		New Tail pipe, # 300 Gas, Stock
029	9-18	64 Ford 6	170	0	041106	3000	10.3	12.9	23.2/19.0	525D	2300	2300	12B	37B	11B	20	11.0	5.5	0.5	5.5	3.3	12	O, F	Use Gas 100 octane, [illegible] Vac Adv.
B 030	9-18	63 Impala 8	283	0	090195	3500	11.2	9.3	20.5/16.5	450D/500	2200	2200	4 B	43B	28B	18	16	16	18	16	16	12	Tr, C	1/2 Qt Tr. [illegible]
031	9-19	62 Buick 8	401	1	095102	4500	12.7	13.8	26.5/22.0	575N	2000	2000	12B	35B	21B	17.5	15	15	0	17.5	17.5	14	O, Tr, C, Tr, E	# 300 Gas, exhaust pipe 1" [illegible]
032	9-19	62 Mercury 6	170	0	059066	2750	9.9	29.5	39.4/34	525D	2700	2700	10B	30B	9B	18	7.0	5.0	0	4	3	13 OLI		
033	9-20	64 Chev. 8	283	1	077673	3500	11.2	17.4	28.6/24	450D/500	2100	2100	4B	30B	17B	18	15	15	18	15	15	12	O, C, Ti, E, F	# 200 New Tail pipe, 1 Gal oil, Rad hose
034	9-21	63 Amer. 6	196	0	107260	3000	10.3	5.9	16.2/12.5	550/750	2350	2350	5B	46B	26B	17	13.5	14.0	0	14.5	14.5	13 OLI	F	Stock # 250 C[illegible]

COMMENTS: * Be – Belts ; Br – Brake ; E – Exhaust ; F – Fuel ; C – Coolent ; H – Hose ; O – oil ; Ti – Tires ; Tr – Tran level

WORK SHEET – 27 COLUMN
FORM 1043 (R5-65)

PREPARED BY _____ ORGN. _____ DATE _____ SUBJECT 8880-7001.

APPROVED BY _____ ORGN. _____ DATE _____ Vehicles Information

PAGE ___ OF ___

Uncontrolled Vehicles

IDENTIFYING NUMBER	TEST DATE	DESCRIPTION	CID	A/C	ODOM.	Inertia	HP @ 50 mph	Grade HP	Total HP	ENGINE RPM IDLE	ENGINE RPM W/o VAD	ENGINE RPM W/VAD	TIMING IDLE	TIMING W/o VAD	TIMING W/VAD	MANIFOLD VACUUM IDLE	MANIFOLD VACUUM W/o VAD	MANIFOLD VACUUM W/VAD	DISTRI VACUUM IDLE	DISTRI VACUUM W/o VAD	DISTRI VACUUM W/VAD	Radia. Cap Pressure	Inspection & Adjustment	Comment
△ 035	9-21	62 Chev 8	327	O	122820	4000	12.0	8.0	20.5/16.0	500N/600	2100	2150	8B	39B	22B	20	17.5	17.8	20	17.5	17.8	13	F	#32 Gas
† 036	9-22	61 Buick 8	401	O	088407	4500	12.7	18.1	32.9/26.0	525N/650	2150	2100	12B	29B	14B	16	16	16	0	16	16	14	F	#30 Gas
* 037	9-25	63 Pontiac 8	389	O	113516	4000	12.0	23.1	35.1/30	550D	2100	2100	10B	41B	22B	16	14.2	14.2	0	14.5	14.7	13	O, Tr, E, F	Muffler, #30 Gas, 1 QT ATF, 2 Oil
Y 038	9-28	65 Impala 8	283	O	070900	4000	12.0	8.6	20.6/15.5	600D	2200	2200	4B	37B	21B	19	15.2	14.9	19	15.2	14.9	13 OLL	O, E	1 QT Oil, Gas #32
* B 039	9-29	63 Ford 8	352	1	099177	4000	12.0	11.4	23.4/18.0	500D/550	2000	2000	8B	39B	25B	19.5	14	14	8.5	14	14	13	C	Near Vac Adv
* 040	9-29	64 GTO 8	389	O	089969	3500	11.2	26.3	37.5/31	500N/600	2000	2000	6B	40B	22B	17	14	14	17	14	14	12	O, H, E, F	1 QT Oil, Tailpipe, Radhose, #30 Gas
041	10-2	65 Buick 6		O	098691	3500	11.2	12.7	23.9/18.5	550N	2000	2000	5B	31B	16B	17	13	13	0	12	12	14	O, H, E	Stick, 1 QT Oil, #30 Gas
Y 042	10-4	57 Chev 8	283	O	103538	3500	11.2	17.6	28.8/23.0	450/500	2300	2300	4B	44B	23B	17	13	13	1.0	12	12	12 OLL	E, F, O, C, H, Tr	3 QT Oil, 1 QT ATF, #30 Gas
† 043	10-4	61 Lincoln 8	430	O	085365	5000	13.4	5.6	19.0/14	475D	1800	1800	6B	35B	17B	18	16	15.5	0	15.5	15.5	12	C	
B 044	10-4	65 Datsun 4	1200	O	079924	2500	9.4	9.6	19.0/14	700N	3350	3300	15B	30B	16B	20.5	10.5	8.5	0	10.5	8.5	12		
* 045	10-5	60 Pont 8	389	O	088021	4500	12.7	7.4	20.1/15	500D	2000	2000	6B	37B	19B	17.0	17	17	17	17	17	14		
Y 046	10-9	64 Ambr 8	287	O	099532	3500	11.2	13.8	25.0/19.5	500D	1950	1950	5B	43B	25B	18.5	13.2	13.2	0	12.5	12.5	12		
✓ 047	10-9	61 Impala 8	283	O	116569	4000	12.0	7.0	19.0/14	450D/500	2075	2025	4B	34B	18B	20	15.5	15	20	15.5	15.0	13	Tr.	1 Qt Oil
* 048	10-10	62 Dodge 8	383	1	083008	4000	12.0	12.5	24.5/19	550	1900	1900	7.5B	45.5	24.5B	14	13.4	13.7	6.5	13.0	13.4	13 OLL	O, Tr, F	1 Qt Oil, 1 Qt ATF, 1 Qt [illegible]
049	10-10	63 Dart 6	225	O	084974	3000	10.3	16.3	26.6/21	550N	2300	2250	2.5B	32.5B	21B	19	12	12	0	12	12	13	E, C	#32 Gas
△ 050	10-11	65 Cutlass 8	330	1	059455	3500	11.2	15.4	26.6/21	550N	2200	2200	7.5B	41.5	23.5B	16.5	15	15	16.5	14	14	13	O, E	#32 Gas
✓ 051	10-11	63 Nova 6	194	O	101646	3000	10.3	10.9	21.2/16.0	500N/600N	2200	2200	8.0B	60.B	37B	16.5	12	11	0	11.2	10.2	11	E, E	STD Tr, replace [illegible]
052	10-11	64 Chev 8	283	O	083465	4000	12.0	11.4	23.4/18	500N	2350	2350	4.0B	38.5B	23.0B	17	16	15.5	0	16	15.5	13 OLL	E,	STD Tr, Replace Tr[illegible]
* G 053	10-12	63 Dodge 8	383	1	126856	4000	12.0	11.4	23.4/18	500N	1900	1850	10B	41B	17B	16.5	14	13	0	13.5	12.5	7		
Y 054	10-12	65 Plym 8	273	O	134368	3000	10.3	11.4	21.7/16.5	600N	2350	2350	10B	42.5B	25B	16.5	15	15	12	13.5	13.5	12	E, O	1 Qt Oil, [illegible]
* 055	10-12	61 Merc 8	352	O	104132	4000	12	11.4	23.4/18	525D	2000	2000	6B	37.5	22B	18	17	16.5	0	17	16.5	11		
056	10-13	63 Chev 6	194	O	099999	3000	10.3	10.9	21.2/16	500N	2200	2200	8B	65.B	42B	18	13.8	14	0	10.9	11.6	14 OLL		STD Tr, Replace [illegible]
✓ 057	10-13	62 Impala 8	283	O	081580	3500	11.2	10.0	21.2/16	475D	2250	2250	4.B	38.B	24B	20	14.4	14.1	0	14.4	14.1	13 OLL	E, F	Replace Tail [illegible]
B 058	10-13	65 Dart 6	225	1	069027	3000	10.2	19.7	29.9/24	550N	2220	2220	2.5B	22.5	11.5B	18	10.2	7.2	6.0	10.2	6.8	13	F, Tr,	#32 Gas
B 059	10-16	63 Nova 6	194	1	071754	3000	10.3	11.3	21.6/16.4	500D	2200	2200	8B	64B	44B	20	12	12	20	10.2	10.2	11	O	1 Qt Oil, [illegible]
* 060	10-16	63 Cad 8	390	1	085392	5000	13.4	11.1	24.5/19.0	480D	2000	2000	5.B	41.B	22B	18	16.5	16.1	0	16.2	16.0	13 OLL	O, E, F,	#40 Gas, 1 Qt Oil, [illegible]
✓ 061	10-16	62 Plym 8	318	1	070808	3500	11.2	4.3	15.5/10.8	500N	1900	1900	10B	53B	28B	21	15.5	15.5	0	15.0	15.0	13	O, Tr,	1 Qt ATF, 2 Oil
* 062	10-17	63 Mer 8	390	O	076730	4500	12.7	34.5	47.2/40	500D	2100	2100	8B	42.B	34B	20	12.1	12.3	0	11.6	11.8	12	E, F,	2 Mufflers, #32 Gas
△ 064	10-17	65 Plym. 8	318	O	077437	4000	12.0	7.0	19.0/14	500N	1980	1980	10B	41B	17.2	18.5	14.2	13.0	0	13.8	12.8	12 OLL	F	#32 Gas
✓ 063	10-18	62 Rambl 6	196	O	050509	2750	9.9	4.5	14.6/9.8	500N/600D	1900	1850	10B	35B	24B	18	10.5	10	1.0	10.5	10.0	13	Tr, E, F	#32 Gas, 1 Qt ATF, 1 Qt Oil
△ 065	10-18	63 Plym 8	318	O	040508	3500	11.2	20.8	32.0/26.0	500N	2275	2200	10B	39B	21B	21	13	13	0	13	13	11	O, E,	#32 Gas, 1 Qt Oil
† B 066	10-18	62 Buick 8	401	1	120370	4500	12.7	4.6	17.3/12.5	575D	2000	2000	12B	34B	25B	18.5	7.0	7.0	1.0	13	13	13 OLL	O, E, F	#32 Gas, 2 Qts Oil, [illegible]
067	10-19	63 Chev. 8	283	O	087665	3500	11.2	13.3	24.5/19.0	450D	2250	2250	4.0B	36B	22.B	19.0	15.0	14.5	19.0	15.0	14.5	12 OLL	Tr.	
B 068	10-19	65 Buick 8	300	1	074436	3500	11.2	14.3	25.5/20.1	600D	1900	1900	2.5B	35B	21B	19.5	12	12	19.5	12	12	13		

COMMENTS: _____

WORK SHEET – 27 COLUMN
FORM 1043 (R5-65)

PREPARED BY _____ ORGN. _____ DATE _____ SUBJECT 8880-7002.

APPROVED BY _____ ORGN. _____ DATE _____ VEHICLE INFORMATION (UNCONTROLLED VEHICLES)

PAGE ___ OF ___

IDENTIFYING NUMBER	TEST DATE	DESCRIPTION	CID	A/C	ODOM.	Inertia	HP@ 50mph	Grade HP	Total HP	ENGINE RPM IDLE	ENGINE RPM W/O VAD	ENGINE RPM W/VAD	TIMING IDLE	TIMING W/O VAD	TIMING W/VAD	MANIFOLD VACUUM IDLE	MANIFOLD VACUUM W/O VAD	MANIFOLD VACUUM W/VAD	DISTRI. VACUUM IDLE	DISTRI. VACUUM W/O VAD	DISTRI. VACUUM W/VAD	Radiator Cap Pressure	Inspection & Adjustment	Comment
B 069	10-19	61 Pont 4	195	0	113937	3000	10.3	4.8	15.1/10.5	600D	2200	2200	6.0	43B	23B	21.0	14.0	14.0	21	14	14	14	Tr.	1 Cyl. ATE
* 070	10-20	65 Dodge 8	383	1	079271	4000	12.0	21.2	33.2/27.0	550N	1900	1900	10B	34B	16B	16	13.5	13.5	4.0	12.5	12.5	14 OLE		
* 071	10-20	65 Pont 8	389	0	100001	4500	12.7	13.9	26.6/21.0	560D	1700	1700	6.0B	36B	17.0	19.0	14.	14	19	14	14	13 OLE	Tr. F.	
072	10-20	64 Olds 8	330	0	099150	3500	11.2	12.7	23.9/18.5	500D/550	2050	2050	7.5B	43B	23.5	17	16	16	17	15	15	14 OLE	E.	#359 Gas
* 073	10-23	63 Ford 8	352	0	066900	4000	12.0	15.7	27.7/22.0	500D	2000	2000	8B	39B	24.B	19.	14	14	0	13.5	13.5	13	O, E, H	#[illegible] Gas. & oil [illegible]
* 074	10-23	63 Olds 8	394	1	080455	4500	12.7	6.3	19.0/14	500D	2100	2100	5B	39.B	18B	19.5	17	17	19.5	16	16	15	F.	#[illegible] Gas.
+ 075	10-23	62 Buick 8	401	0	072078	4500	12.7	17.2	29.9/24	575N	2000	2000	12B	34B	20B	17.5	15	15	2.5	14	14	13 OLE	E.	Noise [illegible]
* 076	10-24	60 Olds 8	394	0	104836	4500	12.7	10.1	22.8/17.5	500D	1900	1900	5.0B	27B	16.5B	20.5	14.7	13.5	20.5	13.9	12.8	11		#359 Gas. [illegible]
077	10-24	61 Chev 8	283	0	065127	4000	12.0	7.0	19.0/14.0	475D	2100	2050	4B	31.5B	17.B	20	14.5	14.2	20	14.5	14.2	13 OLE	O, F	
✓ B 078	10-25	63 Rambler 6	199	1	050133	3000	10.3	7.6	17.9/13	550N	2500	2500	8B	39B	2[illegible]B	19	13	13	1.0	13	13	13		
079	10-25	63 Merc 8	260	0	091127	3000	10.3	7.6	17.9/13.0	500D	2400	2400	10B	37B	20B	18	15	15	0	15	15	13 OLE	O	STP Tc.
* B 080	10-26	64 Ford 8	390	0	081362	4500	12.7	33.9	46.6/39.5	500D	2100	2100	6B	37B	17B	20	13	13	0	12	12	12	Tc. E.	1 Qt Oil
✓ 081	10-27	64 Chev. 6	194	0	055507	3000	10.3	4.3	14.6/10.0	500D/600	2150	2150	8B	55B	35B	20	13	13	20	13	13	13	E	Inoc. ATF, Misfire.
+ 082	10-27	65 Buick 8	401	1	087767	4500	12.7	15.0	27.7/22.	550D	2000	2000	25B	36B	[illegible]	19	13.0	13.5	19	13.0	13.5	12	F	Misfire. STP.
✓ 083	10-30	65 Ford 8	289	1	072223	3500	11.2	3.4	14.6/10	500D	1950	1950	6B	53B	20B	18	14.5	16.5	1.0	14	16	13	C, Tc.	Low Comp. #7 Cyl
△ B 084	10-31	62 Olds 8	330	0	038516	3000	10.3	4.3	14.6/10	500D/600	2400	2400	7.5B	43B	20B	18	13.5	13.7	18	13.5	13.7	13		
✓ 085	11-2	64 Chev 6	194	0	055406	3000	10.3	6.5	16.8/12	500D	2200	2300	8B	49B	35B	19	14	14	19	12	12.5	12 OLE	C, E, H	Tail Pipe, Rust Hole
* 086	11-2	60 Cad 8	390	1	120881	5000	13.4	10.0	23.4/18	480D	2000	1950	5B	34B	15.B	19.5	15.5	15.5	10	15.5	15.5	12		No Vac Adv.
087	11-6	63 Amer 6	196	1	096428	3000	10.3	4.8	15.1/10.5	550D	2500	2500	5B	44B	21B	20	15	15	0	15	15	11	F.	#322 Gas. ET. [illegible]
* B 088	11-6	63 Ford 8	352	1	143193	4000	12.0	14.1	26.1/20.5	500D	2100	2050	8B	36B	22B	20	14.5	14.5	3	14	14	13 OLE		Replace Vac Adj
089	11-6	65 Amer 6	232	0	136832	3000	10.3	11.4	21.7/16.0	550D	2300	2300	8B	47B	22B	20	14	14	0	13	13	13 OLE		
△ 090	11-7	64 Olds 8	330	0	095693	4000	12.0	16.8	28.8/23.0	500D	2050	2050	7.5B	40B	22B	20	14.5	14.5	20	14.5	14.5	12	E.	
* 091	11-7	61 Ford 8	352	0	098124	4000	12.0	13.5	25.5/20.0	475D	2000	1750	8B	39B	20B	20	15.5	15.0	3.0	15.0	14.5	13 OLE		Replace
△ 092	11-10	65 Pont 8	326	0	133693	3500	11.2	7.8	19.0/14.0	500D	1750	1775	6B	37B	18B	18.5	15	14.2	18.5	15	14.2	14	O, E	[illegible]
* 093	11-10	65 Merc 8	390	0	159766	4000	12.0	16.8	28.8/23.0	500D	2000	2000	6B	42B	23B		15	15		15	15	13	O, C, F	
* 094	11-10	59 Pont 8	389	0	165455	4500	12.7	15.0	27.7/22.0	500D	1850	1850	6B	41B	22B	20	12	12	20	12	12	12 OLE	C	
* 095	11-14	64 Chev 8	383	1	100353	4000	12.0	4.8	16.8/12.0	500N	1800	1800	10B	44B	22B	17	16	16	0	15.5	15.5	14	O, E	Tail Pipe [illegible]
△ 096	11-14	63 Plym 8	318	0	097023	3000	11.2	14.3	25.5/20	500N	1900	1900	10B	38B	17B	20	14	14	0	14	14	12	O, C, F	[illegible]
✓ B 097	11-15	63 Ford 8	289	0	133920	4000	12.0	4.8	16.8/12.0	500D	2200	2250	10B	43B	27B	19	16	16	0	16	16	13	E	[illegible]
098	11-15	63 Chev 6	194	0	167847	3000	10.3	10.9	21.2/16.0	600	2400	2400	8B	54B	33B	13.5	13	13	0	11	11	13 OLE	E, F	[illegible]
✓ 099	11-17	63 Dart 6	225	0	111848	3000	10.3	14.7	25.0/19.5	550N	2200	2200	0.5	27.5	15.5	20	10.5	9.2	[illegible]	10.2	11.2	13		[illegible]
✓ 100	11-17	64 Dart 6	170	0	115443	[illegible]	[illegible]	15.2	25.5/20	550N	2200	2200	2.5B	27.2	14B	20.5	11.5	11.0	[illegible]	11.0	10.5	13		

COMMENTS: _____

WORK SHEET – 27 COLUMN
FORM 1043 (R9-65)

PREPARED BY Hoc ORGN. ____ DATE ____ SUBJECT 8880-7002 PAGE ____ OF ____

APPROVED BY ____ ORGN. ____ DATE ____ Vehicle Information CONTROLLED VEHICLES

IDENTIFYING NUMBER	TEST DATE	DESCRIPTION	CID	A/C	O DOM.	Inertia	HP @ 50 mph	Grade HP	Total HP	ENGINE RPM IDLE	ENGINE RPM % VAD	ENGINE RPM W/VAD	TIMING IDLE	TIMING % VAD	TIMING W/VAD	MANIFOLD VACUUM IDLE	MANIFOLD VACUUM % VAD	MANIFOLD VACUUM W/VAD	DISTR'L VACUUM IDLE	DISTR'L VACUUM % VAD	DISTR'L VACUUM W/VAD	Radiator Cap Pressure	Inspection Adjustment *	Comment
△ 101	10-31	66 Chev. 8	327	1	058325	4500	12.7	18.3	31.0/25	600D	2200	2200	2.B	42B	28B	18.5	14	14	2.5	14	14	12 OLI	O, C, F	32' Gas 1 qt O.I
X 102	8-1	66 Valiant 8	273	0	101362	3000	10.3	20.5	30.8/26	650N	2200	2200	5.0A	60B	37B	20	9	11	0	10	11.5	14	O,	w/C.A.P.
△ 103	8-2	68 Impala Chev	327	1	068923	4000	12.0	13.4	25.4/21	600D	2200	2200	4.0B	39B	22.5B	20.5	15	15	1.2	16.0	16.0	14	O, Tr.	New Vac. line to M/C Accum
△ 104	8-2	68 Chevelle Pontiac	327	1	036898	3500	11.2	6.4	17.6/13.8	600D A/CON	2200	2200	4.0B/2.0	30B	17B	13	17	16	6.5	18.0	16.5	15		4BBL, 275 HP
† 105	8-4	66 Cad. 8	429	1	079792	5000	13.4	15.2	28.6/24.0	550D	2000	2000	6.0B	33B	19B	16	17	17	0.6	18.3	18.0	13		New Vac Adv.
X 106	8-9	70 Impala Chev	350	1	056276	4000	12.0	10.7	22.7/18.5	600D	1750	1750	4.0	28.0B	16.0B	16	13.5	12.5	0	14.0	13.0	14	C, F,	New Vac Adv. Coolant Return System
X 107	8-3	68 Dodge 8	383	1	048607	4000	12.0	27.9	39.9/34.5	650N	2500	2500	5.0B	42.B	24.5B	17	15	15	3.0	15.5	15.5	13		Left rear tire has a bulge on trend
† 108	8-8	68 Impala Chev	440	1	065343	5500	13.9	9.8	23.7/19.5	600N 900	1800	1800	7.5B	41.5B	22.0B	18	18	16	13	18	14	16 OLI	O, Be,	Bad Rad. Cap.
X 109	8-7	68 Camaro 6	250	0	055206	3000	10.3	3.5	13.8/10.4	500D	1850	1850	4.0B	50B	20.5B	14.5	16.0	15.0	0.8	16.0	14.5	14	O, Bat	Adj. P.S. Belt; Fan Belt; Idle, Mixture, Timing
△ 110	8-18	70 Valiant 8	318	1	036445	3500	11.2	9.3	20.5/16.5	700N	2050	2050	0 T	36B	17B	17.0	14.5	13.0	0	14.0	12.8	13		
✓ 111	8-17	69 Datsun 4	1595 cc	1	052382	2500	9.4	4.1	13.5/10.0	700N	2800	2800	5.0A	42B	31B	20.0	13.0	13.0	1.0	12.5	12.5	14		Car does not idle well
△ 112	8-18	70 Ford 8	302	1	034106	3500	11.2	7.5	18.7/14.8	600D	2200	2200	6.0B	36.5B	17B	19.0	14.5	14.5	0	14.5	13.0	13		Vehicle in Emission Prog. Cannot Adjust
X 113	8-23	66 Ford 8	390	1	101131	4000	12.0	10.1	22.1/18.0	500D 550	2000	2000	6.0/2.0B	36.0B	15B	17/18.5	17.0	16.0	2.5	17.5		13		
X 114	8-21	67 Dodge 8	383	1	100583	4500	12.7	12.0	24.7/20.4	600N A/CON	1850	1850	5.0B	34.5B	13.0B	18.0	15.0	14.5	1.0	15.0	14.5	14 OLI	O	used OLI Cap w/C.A.P.
X 115	8-21	69 Chev 8	350	0	045880	4000	12.0	18.4	30.4/25.6	700N	1750	1750	0 T	28B	11.5B	20.0	15.5	14.0	0	15.8	14.0	13	F	New Vac Adv
X 116	8-22	68 Plym 8	383	1	062210	4000	12.0	28.5	40.5/35.0	600N A/CON	2000	2000	7.5B	40B	26B	18	10.0	8	0.5	11.0		14		equip. w/1bs cap.
X 117	8-23	67 Plym 8	383	1	055051	5000	13.4	19.6	33.0/28.0	600N	2100	2100	5.0B	40B	22.5B	17.5	14.5	14.0	1.5	14.0		14		w/C.A.P.
△ 118	8-24	69 Camaro 8	321	0	045939	3500	11.2	12.0	23.2/19.0	700N	2000	2000	2.0B	40B	20B	19.5	16.0	16.0	0	16.0		14 OLI		STICK, 8# OREL CAP
△ 119	8-24	66 Plym. 8	318	1	075937	4000	12.0	15.6	27.6/23.0	600N A/CON	2000	2000	5.0A	34B	16.5	18.0	14.0	13.5	0	14.5	14.0	12	E,	New Tail pipe & ITS w/C.A.P.
X 120	8-30	67 Mustang 8	289	0	045417	3000	10.3	18.3	28.6/24.0	550D W	2000	2000	6.B	36B	22.8	1B	12.5	13.0	0	13.5	13.5	14		w/Thermistor, Coolant Return System
✓ 121	8-24	69 VW 4	1500 c.c.	0	035731	2000	8.3	11.7	20.0/16.0	850	2700	2700	0 T	37B	28B	/	/	/	0	7.5	7.0	/		Air cooled engine
△ B 122	8-25	67 Camaro 8	327	0	037024	3500	11.2	12.0	23.2/17.0	600D	1900	1900	2B	27B	11B	18.0	15.0	14.0	5.5	15.0		13 OLI		OLI Cap, New water pump
† 123	8-26	70 Mercury 8	429	1	024984	5000	13.4	8.1	21.5/17.5	500D A/CON	1750	1750	4B	33B	16B	19.0	16.0	16.0	0.5	17.0	16.0	13	O, C	1 qt oil
X 124	8-28	67 T-bird 8	390	1	063268	5000	13.4	10.0	23.4/19.2	550D	1900	1900	6B	28B	6.5B	19.0	17.0	16.5	2.0	17.0		13 OLI		blew 2 Tires OLI Cap
△ 125	8-29	69 Nova 8	307	1	071300	3500	11.2	19.6	30.8/26.0	600D	1900	1900	2.B	29B	13B	20.0	12.0	10.0	1.3	11.5	10.0	14	O, C	1 qt oil, New hose
△ 126	8-30	69 Plym 8	318	1	054805	4000	12.0	13.4	25.4/21.0	650N	1900	1900	TDC	40B	27B	19.5	13.0	13.0	2.8	13.0	13.0	14 OLI	O,	1 qt oil, OLI Cap
† 127	9-1	68 Pont GTO 8	400	1	047319	4000	12.0	22.0	34.0/29.0	700N	2100	2050	6B	36B	18B	15.5	15.0	14.5	2.0	15.5		14		Coolant Return System, Stick w/AIR
*B 128	9-1	66 Pont GTO 8	389	0	063194	4000	12.0	22.5	34.5/29.5	600D	2200	2150	4A	31.0B	15B	18	15	14	0.5	15.0		13	Tr E	W/AIR SYSTEM
X 129	9-5	68 Amer. 8	290	1	065597	3500	11.2	2.8	14.0/10.5	550D	2150	2100	TDC	47B	25B	18	17.2	16.6	0	17.2		13		
*B 130	9-5	69 Cougar 8	351	1	054495	4000	12.0	10.7	22.7/18.5	575D W/A.con	2000	2000	6B	45B	26B	19.5	17.5	15.8	0.5	18		13	F, Ti	Rotate tire
△ B 131	9-6	68 Cougar 8	302	0	042113	3500	11.2	19.6	30.8/26.0	550D	2200	2150	6B	24B	12B	20	13	12.8	0	13.2		13 OLI		
△ 132	9-7	68 LTD 8	302	0	122781	4000	12.0	8.5	20.5/16.5	550D	1900	1900	6B	35B	19B	18.5	14.5	14.0	0.3	14.8		13 OLI	C, Tr.	2/3 pt. ATF. Dual Diac. vac. adv.
△ 133	9-7	66 Dodge 8	318	1	78950	3500	11.2	19.6	30.8/26	600N	1950	1950	5A	34B	15B	16.0	13.0	12.0	7.0	14.0		14 OLI		
* 134	9-8	68 F-85 Cutlass 8	350	0	060741	4000	12.0	4.2	16.2/12.5	575D	2000	1950	5B	37B	16.5B	17.5	17.5	16.5	0	17.2		13		

COMMENTS: * Be – Belts ; Br – Brake ; C – Coolent ; E – Exhaust ; F – Fuel ; H – Hose ; O – oil ; Ti – Tires ; Tr – Tran. level

WORK SHEET – 27 COLUMN
FORM 1048 (R8-69)

PREPARED BY _____ ORGN. _____ DATE _____ SUBJECT 8880-7002 PAGE ___ OF ___

APPROVED BY _____ ORGN. _____ DATE _____ Vehicles Information (Controlled Vehicles)

IDENTIFYING NUMBER	TEST DATE	DESCRIPTION	CID	A/C	ODOM	Inertia	HP@ 50 mph	~~Grade~~ HP	TOTAL HP	ENGINE RPM IDLE	ENGINE RPM W/O VAC	ENGINE RPM W/VAC	TIMING IDLE	TIMING W/O VAC	TIMING W/VAC	MANIFOLD VACUUM IDLE	MANIFOLD VACUUM W/O VAC	MANIFOLD VACUUM W/VAC	DISTRI VACUUM IDLE	DISTRI VACUUM W/O VAC	DISTRI VACUUM W/VAC	Radia. Cap Pressure	Inspection & Adjustment	Comment
Δ 135	9-8	66 Cutlass 8	330	1	117746	3500	11.2	6.2	17.4/15.6	600D	2000	2000	5B	38B	21B	17.0	15.3	14.8	0.3	15.3		13 OLT		
+ 136	9-8	66 Mercury 8	428	1	061193	4500	12.7	6.3	19.0/15.2	550D	—	—	6B	39B	25B	20	14.3	14.2	0.5	14		13 OLT	O, Tr, C.	New Vac. Adv. 2 qt oil, 1 qt ATF
Δ 137	9-11	69 Amer 8	343	1	061854	4000	12.0	6.3	18.3/14.5	550D	1900	1900	TDC	49B	30B	17	16.5	16.0	4.0	17.6		13	Tr, F,	#100 Gas 1 qt ATF
* 138	9-11	70 Cutlass 8	350	1	023683	3500	11.2	3.9	15.1/11.5	600D	1750	1750	4B	34B	16B	17.5	15.5	14.5	0	16.2		14	F	#200 Gas.
Δ 139	9-11	67 Tempest 8	326	1	061848	3500	11.2	8.8	20.0/16.0	600D	1750	1800	6B	41B	25B	17.0	11.5	11.5	0	13.2		14	F,	#229 Gas
* 140	9-12	67 Chry 8	383	1	041812	4500	12.7	20.3	33.0/28.0	600N	2000	2000	5B	31B	10B	17	16.0	13.5	0.5	15.5		15	F, O,	1 qt oil, #267 Gas
+ 141	9-12	69 Ford 8	429	1	058637	4500	12.7	10.5	23.2/18.0	575D	1800	1800	6B	39B	20B	20	16.0	16.0	2.0	17.0		13	Tr, Ti	1 qt. ATF.
* 142	9-12	71 Ford 8	351	1	051740	4000	12.0	3.0	15.0/11.4	600D	1750	1750	6B	37B	12B	16.5	15.0	12.2	0.5	15.0		13	F, Ti	#300 Gas
X 143	9-13	67 Cougar 8	289	0	038680	3500	11.2	10.9	22.1/18.0	550D	2000	2000	6B	37B	22.5B	19	13.5	13.4	0	14.5		13 OLT		
X 144	9-13	67 Chev 6	250	0	051411	4000	12.0	10.1	22.1/18.0	500D	2050	2050	4B	42B	21.5B	18.5	14	14	0	14.5		13 OLT	Ti, F	#200 Gas Replace 2 freeze plugs.
Δ 145	9-13	68 Dart 8	318	1	050465	3500	11.2	19.6	30.8/26.0	600N	2050	2050	2.5A	44.5B	24.5B	18	13.2	13.2	0.5	13.3		14 OLT	C	A/C not work, 1 ign wire
+ B 146	9-14	69 Pontiac 8	400	1	047568	4500	12.7	8.5	21.2/17.2	650D	1750	1750	9B	31B	20B	19.5	15.0	14.4	0	15	13.8	12	O, E	new tail pipe, 1 qt oil
✓ 147	9-14	68 Corona 4	1100/115	0	032372	2500	9.4			650D	2700	2650	5B	48B	28B	18	11.2	11.2	0	9.5	10	7	Tr	1 qt ATF
* 148	9-15	70 Chev Impala 8	350	1	022558	4000	12.0	4.7	16.7/12.0	600D	1800	1800	4B	37.5	16B	20	16.5	16	0.5	16	16	14	F	#200 Gas
* 149	9-18	68 Mercury 8	390	1	048345	4500	12.7	19.2	31.9/27.0	550D	1850	1850	6B	39B	20B	19	14.0	13.5	0	14.0	13.5	13		
+ 150	9-19	66 Buick Electra 8	401	0	064041	4500	12.7	19.2	31.9/27.0	500D	2000	2000	2.5B	35B	18B	18	16	16	1.0	15.5	15.5	13 OLT	O, E	repair resonator & tail pipe
* 151	9-20	69 Chev Impala 8	350	1	050463	4000	12.0	17.7	29.7/25.0	600D	1850	1825	4B	40B	19B	19	14.5	14.5	0	15	15	13	C, H	Replace heater hose
* 152	9-20	69 Malibu 8	350	1	042908	3500	11.2	4.5	15.7/12.0	600D	1800	1700	4B	38B	12B	18.5	17.2	17.0	0	17.5	17	15	Tr, Ti, F	#300 Gas. 1 qt ATF.
X B 153	9-21	66 Nova 8	283	1	052203	3000	10.3	12.4	22.7/18.5	600D	2100	2100	4B	29B	16B	16.0	15.5	14.5	0	14.5	14.5	13	Tr.	1 qt ATF
C B 154	9-22	66 Mustang 8	289	0	073528	3000	10.3	6.4	16.7/13.0	575D	2150	2150	0	22B	0B	17	13	6	0.5	7.0	2.0	12	O, E, F	1 qt oil, Muffler #200 Gas 1 qt ATF
+ 155	9-22	70 GTO 8	400	0	044743	4000	12.0	8.5	20.5/16.5	950N	2300	2200	9B	39B	19B	20	17.5	17.5	20	17.5	17.5	13		stick
+ 156	9-25	67 Riviera 8	430	1	077660	4500	12.7	19.2	31.9/27.0	600D	1900	1900	2.5B	36.5B	24.5B	17	14.0	14.0	4.0	13.4	13.4	12.0		
* 157	9-25	69 Plym 8	383	1	050905	4500	12.7	13.2	25.9/21.5	600N	1800	1800	7.5B	47.5B	25B	17	14.0	14.0	0	13.5	13.5	10.0	F	#200 Gas
+ 158	9-26	69 Buick 8	430	1	126192	4500	12.7	18.1	30.8/26	550	1790	1790	TDC	38B	21.5B	15	15	15	4.0	15.0	12.8	13		
Δ 159	9-26	67 Chev Impala 8	327	1	093341	4500	12.7	19.2	31.9/27	600D	2150	2150	6B	37B	22B	17	16	15.2	0	15.5	15.2	12	O, C, F	#300 Gas, 1 qt oil
* 160	9-26	69 Chry 8	383	1	063987	4500	12.7	12.7	25.4/21	600N	1800	1700	7.5B	41B	19B	15	15	15	4.5	14	14	14	O	1 qt oil
O 161	9-27	68 Valiant 6	225	0	136463	3000	10.3	21.6	31.9/27.0	650N	2000	2000	TDC	35B	22B	17	8	8	0	8	7.8	12	F	#200 Gas
Δ 162	9-27	66 Cutlass 8	336	1	056428	3500	11.2	7.7	18.9/15	600D	2150	2050	5B	40B	22B	15	14	15	2.0	14	14	12	F	#250 Gas.
✓ 163	9-27	68 Opel 4	1900/166	0	047505	2250	8.8	10.1	18.9/15	750N	2950	2800	TDC	52B	38B	16	5	5	0	5	6	7		stick
✓ 164	9-28	67 Ford Fairlane 8	289	1	090192	3500	11.2	10.0	21.2/16	550D	2000	2000	6B	39B	23B	17	16	16	0	16.5	16.5	13	O	1 qt oil
* 165	9-28	69 Chev Impala 8	396	1	033207	4500	12.7	9.0	21.7/16.5	600D	1800	1750	4B	32B	17B	20	16.0	14.5	14.5	16.0	14.5	14	O, F	1 qt oil #250 Gas
Y 166	9-29	68 Mustang 8	289	1	094668	3500	11.2	7.8	19.0/14.0	550D	2100	2050	6B	39B	13B	18	15	13	0	14.5	11.5	12.0	C, Tr	1 qt ATF
✓ 167	1-14	69 Datsun 4	1600/97.3	0	049160	2500	9.4	4.1	13.5/9.0	700N	2700	2700	10B	54B	26B	17	13	13	0	12.5	12.5	13.0		
Δ 168	10-2	68 Dodge	318	1	064946	3500	11.2	18.7	29.9/24	600N	1900	1900	10B	30B	14B	19	12	11	0	11.5	11.0	14	O, H,	1 qt oil Rad hose

COMMENTS: _____

WORK SHEET – 27 COLUMN
FORM 1045 (RB-68)

PREPARED BY _____ ORGN. _____ DATE _____ SUBJECT 8880-7002 PAGE ___ OF ___

APPROVED BY _____ ORGN. _____ DATE _____ Vehicles Information (Controlled Vehicles)

IDENTIFYING NUMBER	TEST DATE	DESCRIPTION	CID	A/C	ODOM.	Inertia	HP@ 50 MPH	Grade HP	Total HP	ENGINE RPM IDLE	ENGINE RPM W/O VAD	ENGINE RPM W/VAD	TIMING IDLE	TIMING W/O VAD	TIMING W/VAD	MANIFOLD VACUUM IDLE	MANIFOLD VACUUM W/O VAD	MANIFOLD VACUUM W/VAD	DISTRI VACUUM IDLE	DISTRI VACUUM W/O VAD	DISTRI VACUUM W/VAD	Radiator Cap Pressure	Inspection & Adjustment	Comment
✓ 169	10-3	70 Toyota 4	1900	0	016766	2500	9.4	17.2	26.6/21	650N/600	2500	2500	5B	38B	22B	17.5	5.5	5.5	0	6.0	0	7 OLE	O,	STICK, 1QT OIL
✓ 170	10-3	71 Datsun 4	1595 97.4	0	021884	2500	9.4	1.1	10.5/6.2	575/600	2900	2900	10B	35B	22B	18.5	13.0	12.8	0	12.8	0	13		
✗ 171	10-3	70 Ford 8	351	0	028024	4500	11.2	17.6	28.8/23	600D	1850	1800	10B	25B	12B	18	14	13.5	0	15	0	12		
✓ 172	10-5	67 Toyota 4	1879 115.7	0	044889	2500	9.4	1.1	10.5/6.2	550D	2700	2600	12B	50B	30B	15	9	7.5	0	9.0	7.5	7 OLE	O, C,	1QT OIL
✗ 173	10-5	69 Ford 8	390	1	080365	4500	12.7	20.5	33.2/27	550D	1800	1800	6B	37B	19B	15.5	13.5	12.5	0	13.5	12.5	13	Tr, F	1QT ATF, $20° Gas
✗ 174	10-6	67 T-bird 8	390	1	059712	4500	12.7	12.8	25.5/20	550D	1950	1950	6B	40B	21.5B	19	15.2	15.0	0	15.7	0	12		New Vac Adj
✗ 175	10-6	66 Mustang 6	200	0	058556	3000	10.3	17.4	27.7/22	575D	2200	2200	TDC	34B	20.5B	17	8.5	8.0	0	8.5	0	14	E, Tr, C.	$200 Gas 1QT ATF
✓ 176	10-6	67 Cutlass 8	230	1	076201	3500	11.2	8.9	20.1/15	600D	2100	2100	7.5B	40B	24B	17.5	15.0	14.2	0.5	15.0	0	15		
✗ 177	10-9	66 Ford 8	352	0	054162	4000	12.0	12.5	24.5/19	550D	1920	1920	TDC	39B	18B	19.0	15.3	14.8	0	15.2	14.5	13 OLE	C, Tr, F.	$30° Gas 1QT ATF
✓ 178	10-10	70 VW 4	1500cc	0	051088	2500	9.4	18.3	27.7/22.0	850N	2600	2500	TDC	36B	4.0B	16.	5.0	2.0	0	2.0	1.0	—		* Extreme Power Loss
✗ 179	10-24	68 Pont 8	400	1	051364	4500	12.7	4.1	16.8/12.0	650D	1700	1700	9B	31B	18B	21	15	13.5	0	14.0	12.5	13		
✗ 180	10-25	69 Dodge 8	383	1	069944	4500	12.7	17.2	29.9/24	600N	1900	1900	7.5B	46B	25B	18	15	14.5	0	14	13	12		
✗ 181	10-26	69 Olds 8	455	1	063203	4500	12.7	6.3	19.0/14	600D	1700	1700	8B	35B	14B	19	16	15	0	16	15	13	F, O, Tr.	$30° Gas, Replace T.P., 1QT Oil 1QT ATF
✗ 182	10-26	68 Buick 8	430	1	032010	4500	12.7	11.8	24.5/19	550D	2000	2000	TDC	36.5	22B	16	15.5	15	0	14	13	16	O	1QT oil
✗ 183	10-27	67 Chev 8	Nova 283	0	075737	3000	10.3	7.0	17.3/12.5	600D	1950	1900	4B	32B	16.B	17.5	15	15	15	14	13.8	14		
✗ B 184	10-30	66 Toyota 4	1900 116	0	050596	2250	8.8	10.2	19.0/14	650N	2550	2550	5B	40.5B	20B	19.0	9.0	9.0	0	8.5	8.5	12	E	STD Tr, Replace T.P.
✗ 185	10-30	70 Pont. 8	350	0	031318	4000	12.0	13.5	25.5/20	650	2000	1850	9B	37B	20B	21	12.5	11.0	2.1.0	12.5	11.0	12		
✗ 186	10-31	70 Buick 8	350	1	062537	4500	12.7	8.5	21.2/16	600D	1900	1900	6.B	34B	17B	19	15	14.8	0.5	14.7	14.2	12	O, F	$30° Gas, 2QT Oil
✓ 187	11-1	69 Toyota 4	1900	0	068323	2500	9.4	6.3	15.7/11	650D	2800	2700	5B	47B	23B	18	10	9.0	0	9.5	9	7.0 OLE		
✗ 188	11-1	70 Plym 8	383	1	070577	4000	12.0	14.1	26.1/20.5	650N	2000	2000	2.5B	39B	19B	16	14.5	13.	1.0	14.5	13.0	13	F, C, Be	$25° Gas, Replace Ign wire & water-pump
✗ 189	11-1	66 Cad	429	1	08 8018	5000	13.4	3.4	16.8/12.	550D	2000	1950	5.0B	32B	18B	20.	17	17	1.0	17	17	12 OLE	F, O, C, Tr, H,	New Vac Adj $30° Gas 1QT ATF, 1QT Oil Hose
✗ 190	11-2	70 Cougar 8	351	1	036722	3500	11.2	5.6	16.8/12	600D	2000	2000	6.B	43B	22.B	19	17	16	0	17	16	12	C	
✗ 191	11-3	68 Ford 8	390	1	049957	4500	12.7	9.6	22.3/17	550D	1800	1800	6B	41B	19B	19.5	15	15	0	15.0	15.0	12		
✗ 192	11-3	69 Ford 8	390	1	047750	4500	12.7	18.8	31.5/25.5	550D	1900	1900	6B	37B	17B	17	14.5	14.5	0.5	14	14	13	E, F.	Muffler, Pro. Gas
✗ 193	11-7	68 Pont. 6	250	0	067461	3500	11.2	18.7	29.9/24.0	600D	2200	2200	TDC	34B	20B	17.5	10	8.5	2.0	10.0	8.5	14.		
△ 194	11-8	68 Dodge 8	318	0	064810	4000	12.0	20.6	32.6/26.5	600N	2050	2050	2.5A	35B	19B	19	12	11.7	1.0	12.0	11.7	14.	H, E	Heater Hose $35° Gas
✗ 195	11-9	69 Merc. 8	Cougar 351	1	048721	3500	11.2	36.0	47.2/40	550D	2000	2000	6B	39B	22B	20	10	10	0	9.5	9.5	12	F	$30° Gas
✗ 196	11-9	67 Dodge 8	273	1	068666	3500	11.2	13.3	24.5/19.0	650N	2000	2000	5A	33B	9.0B	18.5	13.0	12.0	4.5	13.0	12.0	13 OLE		
✗ 198	11-13	68 Amer 8	290	0	060167	3500	11.2	3.4	14.6/10.0	550D	2200	2200	TDC	41B	20B	16.5	14.0	14.0	0	15.5	15.5	13	F	$30° Gas
✗ 197	11-13	66 Ford 8	289	0	080919	3500	11.2	8.3	19.5/14.5	550D	2000	2000	TDC	35.5	22B	19	14.0	14.0	1.0	12	12	12	E.	Muffler, New Vac Adj
✓ 199	11-17	69 Datsun.	1600 97.3	0	054397	2500	9.4	2.0	11.4/7.0	700N	2750	2750	5A	51B	32B		13	13		13	13	12	F	$30° Gas STD TRANS
✗ 200	11-17	69 Mustang 8	351	0	081782	3500	11.2	18.7	29.9/24	650N	2000	2000	6B	34B	21B	19	14	14	14	14	14	13	F	1QT Gas STD TRAN

COMMENTS: _____