

E. O. Book

State of California
AIR RESOURCES BOARD

EXECUTIVE ORDER D-70-1
Relating to Exemptions under Section 27156
of the Vehicle Code

MALLORY ELECTRIC COMPANY
"MALLORY UNILITE MODEL 502"
BREAKERLESS IGNITION CONVERSION UNIT

Pursuant to the authority vested in the Air Resources Board by Section 27156 of the Vehicle Code; and

Pursuant to the authority vested in the undersigned by Section 39515 of the Health and Safety Code and Executive Order G-30A;

IT IS ORDERED AND RESOLVED: That the installation of the "Mallory Unilite Model 502" breakerless ignition conversion unit manufactured by Mallory Electric Company, Division of W. R. Grace & Co., 1801 Oregon Street, Carson City, Nevada 89701 has been found to not reduce the effectiveness of required motor vehicle pollution control devices and, therefore, is exempt from the prohibitions of Section 27156 of the Vehicle Code for installation on 1972-1976 model year Ford 8 cylinder vehicles equipped with a pivoted concentric breaker plate distributor except as follows:

- 1) Those vehicles originally equipped with breakerless ignition systems.
- 2) Those 1966 through 1970 vehicles equipped with "NO_x retrofit devices" with a 4° retard in basic ignition timing (i.e., Carter, Echlin, STP Air Computer, Pure Power - Electro-NO_x).

This device is a miniaturized breakerless conversion unit which is installed inside the distributor. It consists of an opto/electronic module and a shutter wheel. The electronic module consists of a light emitting diode, an infrared detector, and a transistor switching circuit.

This Executive Order is valid provided that installation instructions for this device will not recommend tuning the vehicle to specifications different from those listed by the vehicle manufacturer.

Changes made to the design or operating conditions of the device, as exempted by the Air Resources Board, that adversely affect the performance of a vehicle's pollution control system shall invalidate this Executive Order.

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Marketing of this device using an identification other than that shown in this Executive Order or marketing of this device for an application other than those listed in this Executive Order shall be prohibited unless prior approval is obtained from the Air Resources Board.

This Executive Order does not constitute any opinion as to the effect that the use of this device may have on any warranty either expressed or implied by the vehicle manufacturer.

THIS EXECUTIVE ORDER DOES NOT CONSTITUTE A CERTIFICATION, ACCREDITATION, APPROVAL, OR ANY OTHER TYPE OF ENDORSEMENT BY THE AIR RESOURCES BOARD OF ANY CLAIMS OF THE APPLICANT CONCERNING ANTI-POLLUTION BENEFITS OR ANY ALLEGED BENEFITS OF THE "MALLORY UNILITE MODEL 502" DEVICE.

No claim of any kind, such as "Approved by Air Resources Board" may be made with respect to the action taken herein in any advertising or other oral or written communication.

Section 17500 of the Business and Professions Code makes untrue or misleading advertising unlawful, and Section 17534 makes violation punishable as a misdemeanor.

Section 43644 of the Health and Safety Code provides as follows:

"43644. (a) No person shall install, sell, offer for sale, or advertise, or, except in an application to the state board for certification of a device, represent, any device as a motor vehicle pollution control device for use on any used motor vehicle unless that device has been certified by the state board. No person shall sell, offer for sale, advertise, or represent any motor vehicle pollution control device as a certified device which, in fact, is not a certified device. Any violation of this subdivision is a misdemeanor."

Any apparent violation of the conditions of this Executive Order will be submitted to the Attorney General of California for such action as he deems advisable.

Executed at Sacramento, California, this 28th day of October, 1976.

Original Signed By

Thomas C. Austin
Deputy Executive Officer-Technical

State of California

AIR RESOURCES BOARD

October 8, 1976

Staff Report

Evaluation of Mallory Electric Company
"Mallory Unilite Model 502" Breakerless
Conversion Unit for Exemption from
the Provisions of Section 27156 of the
Vehicle Code

I. Introduction

Mallory Electric Company, Division of W. R. Grace & Co., 1801 Oregon Street, Carson City, Nevada, 89701, has applied for an exemption for its breakerless ignition conversion device, "Mallory Unilite Model 502". The applicant intends to market the device for installation on 1972 through 1976 model year Ford 8 cylinder vehicles equipped with a pivotal concentric breaker plate distributor. (Exhibit A).

The applicant has been previously granted an exemption by Executive Order D-70, dated September 19, 1976 for the same device identified as "Mallory Unilite Model 501" for Delco 8 cylinder applications.

The Model 501 is electrically identically to the Model 502.

II. System Description

The device is a unit to replace the contact points within the distributor. The opto/electronic module consists of a light emitting diode, an infrared detector, and a transistor switching circuit. The module has been reduced in size through the use of thick film hybrid solid state circuitry.

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The module is mounted onto the distributor breaker plate using the screws supplied. The shutter wheel has cut windows to allow light passage to activate the detector at the appropriate intervals. The wheel is mounted onto the distributor drive plate. Exhibit B shows the electrical schematic of the device and Exhibit C is a copy of the installation instructions.

III. System Evaluation

A. Laboratory Tests

The applicant did not submit any emission data indicating the device will not have any adverse effect on the emission control system. In lieu of emission tests the applicant submitted an ignition bench test on a 1974 Ford 8 cylinder distributor by comparing the output characteristics of the ignition system with and without the device. The test was accomplished on an ignition system simulator in accordance with "ARB Guidelines for Testing and Criteria for Emission Compliance of Ignition System Modifications". The ARB performed a confirmatory test on a 1973 Ford 8 cylinder distributor. Table I and II are the summaries of the applicant's test data and the ARB Laboratory test results.

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B. Analysis of Test Results

1. Applicant's Test Data

The back-to-back ignition system test data submitted by the applicant did not show any significant change in the centrifugal and vacuum advance of the distributor tested. In addition, no degradation was noted of other critical ignition system parameters such as spark duration, rise time, available secondary voltage, and energy.

2. ARB Test Data

The ARB confirmatory test showed that the device introduced a maximum of 6° engine ignition retard. This 6° retard consisted of one degree delay in centrifugal advance and 5 degrees delay in vacuum advance. A special test conducted with the governor of the distributor locked, however, showed no intrinsic advance or delay in the "Unilite" electronic module indicating that the centrifugal delay noted above could have been due to the test variability. Likewise the vacuum advance data points have one degree test variability due to a $\pm 0.5^\circ$ accuracy in the distributor advance test bench readings. It is the staff's judgement that the 2° retard in excess of the ARB maximum 4° retard criteria can be attributed to the test variability.

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Table II also shows that the other critical ignition parameters were not adversely affected by the installation of the "Unilite" device.

C. Manufacturers Claims

The applicant claims the installation of the device on the motor vehicles will reduce tune ups, maintenance and adjustments.

It is the staff's judgement that the installation of the device on a vehicle could result in the following:

1. This breakerless system offers potential for reduced maintenance.
2. The electrical characteristics of this system do not indicate any significant benefits on the performance, fuel economy and emissions reduction greater than that would be expected from a properly tuned engine.

D. Modification of the Installation Instructions

Item No. 6 of the manufacturer's installation instructions recommends advancing the ignition timing so engine slightly pings under heavy load to obtain maximum engine performance and fuel economy. Advancing the ignition timing over the manufacturer's specifications is not allowed per ARB ignition

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system modifications criteria since this will increase the production of NOx. The applicant was requested and agreed to delete the above recommendation from the installation instructions.

IV. Conclusion and Recommendation

The above evaluation of the "Mallory Unilite Model 502" unit by the ARB staff showed that the installation of the device will not adversely affect the ignition characteristics of the OEM ignition system.

The staff therefore recommends that Mallory Electric Company be granted an exemption from the prohibitions of Section 27156 of the California Vehicle Code for its "Mallory Unilite Model 502" LED breakerless ignition system for installation on 1972 through 1976 model year Ford 8 cylinder vehicles equipped with a pivotal concentric breaker plate distributor except as follows:

1. Those vehicles originally equipped with breakerless ignition systems.
2. Those 1966 through 1970 vehicles equipped with "NOx retrofit devices" with a 4° retard in basic ignition timing (i.e., Carter, Echlin, STP Air Computer, Pure Power - Electro-NOx).

Table I - Mallory Unilite Breakerless Ignition System Data Summary
for 1974 Ford 8 Cylinder Distributor (Applicant's Test Data)

A. Centrifugal Spark Advance in Crankshaft Degrees

<u>Engine RPM</u>	<u>Baseline</u>	<u>Device</u>
800	0	0
1400	6.5	7.0
2000	11.5	11.0
2600	16.0	16.0
3000	20.0	20.0

B. Vacuum Spark Advance in Crankshaft Degrees

<u>Vacuum in. Hg.</u>	<u>Baseline</u>	<u>Device</u>
6	0.5	1.0
9	7.0	6.0
12	12.5	11.0
15	17.0	14.0
18	20.0	17.0
20	22.0	18.0

C. Spark Duration in Microseconds

<u>Engine RPM</u>	<u>Baseline</u>	<u>Device</u>
600	900	700
3000	500	500

D. Secondary Voltage Rise Time in Microseconds

<u>Engine RPM</u>	<u>Baseline</u>	<u>Device</u>
600	22	22
3000	30	25

E. Spark Energy in Millijoules

<u>Engine RPM</u>	<u>Baseline</u>	<u>Device</u>
600	30	25
3000	12	10

F. Available Secondary Voltage in Kilovolts (simulating fouled spark plug)

<u>Engine RPM</u>	<u>Baseline</u>	<u>Device</u>
600	14	14
3000	12.5	12

G. Available Secondary Voltage in Kilovolts (with load)

<u>Engine RPM</u>	<u>Baseline</u>	<u>Device</u>
600	20	20
3000	17	16

Table II - Mallory Unilite Breakerless Ignition System Data Summary for
1973 Ford 8 Cylinder Distributor (ARB Confirmatory Test)

A. Centrifugal Spark Advance in Crankshaft Degrees

<u>Engine RPM</u>	<u>Baseline</u>	<u>Device</u>	<u>Electrical Delay*</u>
800	0	0	0
1400	6.5	6.0	0
2000	11.0	10.0	0
2600	13.5	13.0	0
3000	16.0	15.5	0

B. Vacuum Spark Advance in Crankshaft Degrees

<u>Vacuum in. Hg.</u>	<u>Baseline</u>	<u>Device</u>
6	2	0.5
9	10.5	7.0
12	16.5	13.0
15	21.0	16.5
18	24.0	19.0
20	24.5	21.0

C. Spark Duration in Microseconds

<u>Engine RPM</u>	<u>Baseline</u>	<u>Device</u>
600	1400	1200
3000	1100	880

D. Secondary Voltage Rise Time in Microseconds

<u>Engine RPM</u>	<u>Baseline</u>	<u>Device</u>
600	120	100
3000	120	100

E. Spark Energy in Millijoules

<u>Engine RPM</u>	<u>Baseline</u>	<u>Device</u>
600	22.4	19.8
3000	15.7	17.6

F. Available Secondary Voltage in Killevolts (simulating fouled spark plug)

<u>Engine RPM</u>	<u>Baseline</u>	<u>Device</u>
600	15.0	13.5
3000	12.5	12.5

G. Available Secondary Voltage in Killevolts (with load)

<u>Engine RPM</u>	<u>Baseline</u>	<u>Device</u>
600	23.5	21.0
3000	18.5	19.0

*Tested with distributor governor locked.

Automotive Specialties Division

GRACE

W. R. Grace & Co.
7091 Belgrave Ave.
Garden Grove, Calif. 92641

(714) 893-0595

September 8, 1976

Mr. G. C. Hass, Chief
Vehicle Emissions Control Program
Air Resources Board
9528 Telstar Avenue
El Monte, California 91731

Subject: Application for an ARB Resolution of Compliance with Section 27156 of the California Vehicle Code.

Dear Mr. Hass:

This letter is an application for an ARB resolution of compliance with Section 27156 of the California Vehicle Code for the Mallory Unilite electronic conversion for the 72 and later concentric Ford Distributors.

I am applying for the exemption in behalf of the Mallory Electric Company, a wholly owned subsidiary of the W. R. Grace Company of New York.

A copy of a letter authorizing me to act in behalf of Mallory Electric has been previously submitted.

Description Of Device

The device is a unique breakerless conversion ignition device that incorporates numerous design changes making it totally different than the previous SS-1 conversion unit.

The new unit has been reduced in size through the use of thick film hybrid solid state circuitry allowing the entire package to be mounted inside the distributor offering simplified installation.

GRACE

Mr. G. C. Hass

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8 September 1976

Purpose of the Device

The purpose of the device is to replace the conventional breaker points with a non-contacting infrared triggered unit. The conversion eliminates the effects of point contact wear, timing changes, & reduced energy output of the conventional point contact system. It thereby offers reduced tuneup maintenance & adjustments.

Installation Instructions

Detailed instruction sheets as well as two sample units will be immediately forwarded under separate cover for your evaluation.

Test Data

Bench test data has been supplied as per The ARB guidelines of 3-1-76 for the Concentric Vacuum Plate Ford Distributor. The tests were performed with strict adherence to the ARB guidelines for testing & evaluation of Ignition system modifications. A copy is attached.

The data on the Ford unit was taken using the D3AF12127AB Concentric vacuum advance plate.

Application of the Device

The Unilite #502 is manufactured for use with the 8 cylinder Ford distributor from 1972 and later with conventional breaker point ignition. If you have any questions regarding the enclosed information, please do not hesitate to call.

Sincerely,



Andy Krumm
Director of Research & Development

Automotive Specialties Division

GRACE

W. R. Grace & Co.
7091 Belgrave Ave.
Garden Grove, Calif. 92641

(714) 893-0595

October 1, 1976

California
Air Resources Board
9528 Telstar Ave.
El Monte, CA 91731

Attn: Fernand Tan

Dear Mr. Tan:

Regarding our recent telephone conversation concerning the letter from Mr. Drachand, please modify the Mallory application to cover the 1972 through 1976 model year Ford eight cylinder distributors equipped with a pivotal concentric breaker plate.

The circuit diagram of the model 502 is identical to the 501 unit you have previously evaluated. However, I have asked that one be forwarded to you with the two sample devices.

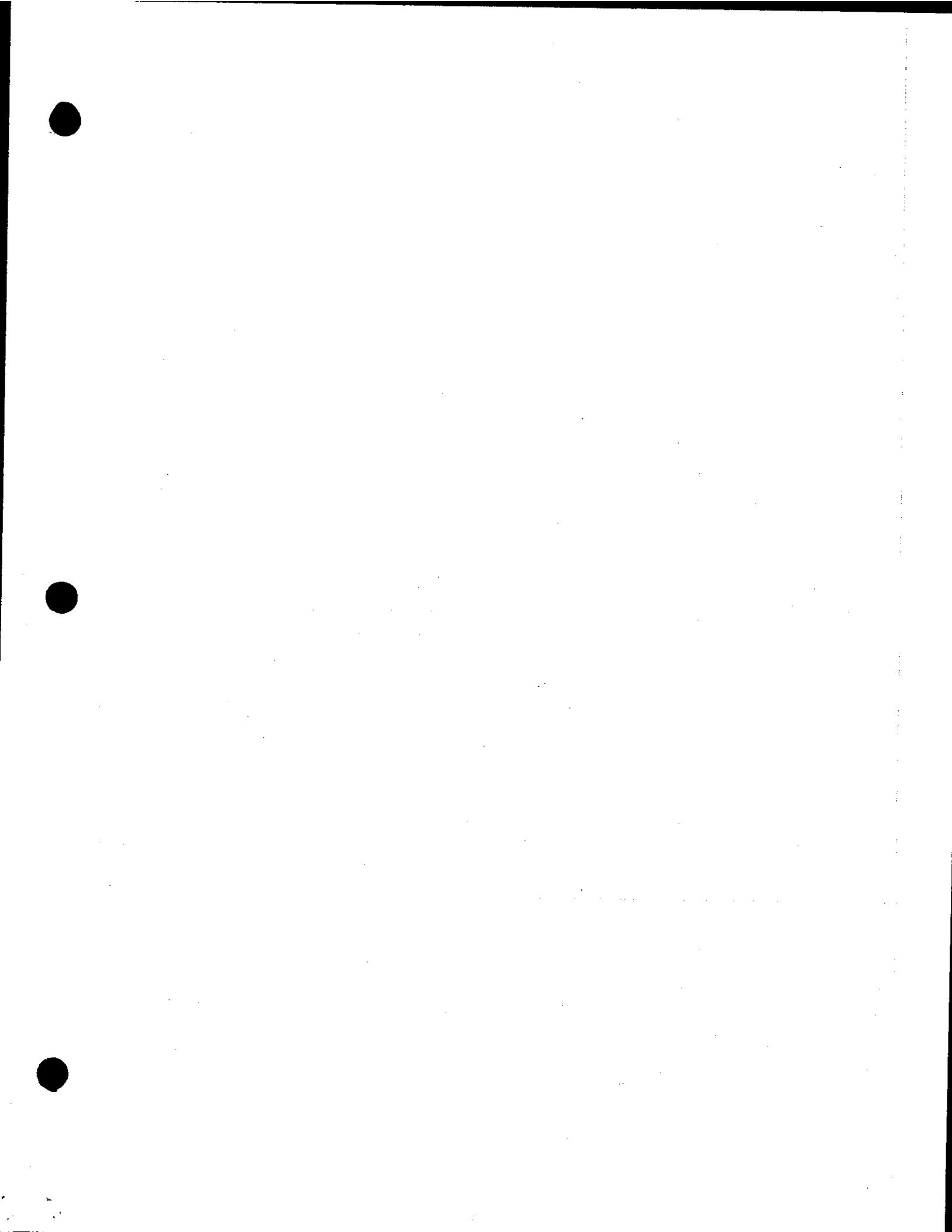
Please contact me if you have any further questions.

Sincerely,



Andy Kramm
Director of Research & Development

AK/hr



AMERICA'S IGNITION SPECIALISTS



FOR OVER FIFTY YEARS

MALLORY UNILITE BREAKERLESS ELECTRONIC CONVERSION INSTRUCTIONS FOR FORD 8 CYLINDER, SINGLE POINT DISTRIBUTORS

KIT CAN BE INSTALLED WITHOUT REMOVING DISTRIBUTOR FROM ENGINE

DISASSEMBLE DISTRIBUTOR AS FOLLOWS:

1. Remove and set aside distributor cap to allow clear access to distributor. Do not remove plug wires from cap.
2. Remove points, condenser, primary lead wire and rotor from breaker plate and distributor housing. Leave breaker plate and ground wire intact.

ASSEMBLE DISTRIBUTOR AS FOLLOWS:

1. Using 8-32 x 1/4 flathead screw, install the lower mounting plate, (see Figure A) to the stock circuit breaker plate. Before tightening, check hole alignment on remaining holes in plate.
2. Having secured lower mounting plate, install the upper mounting plate, (refer to Figure A) using (1) 8-32 x 1/4 and (1) 8-32 x 5/16 screw.
3. With mounting plates both secured, install the Mallory UNILITE module, as illustrated, using (2) 6-32 screws provided.

IMPORTANT: CHECK TO MAKE SURE ALL SCREWS ARE TIGHT BEFORE PROCEEDING.

4. Push wires through hole in side of distributor. Slide rubber grommet supplied over wires and fit into hole. With rubber grommet installed, mount connector pins into plastic terminal pin housing supplied. Be sure wires are shoved into connector as shown in Figure B. Shove in until a definite "click" is heard. Install rotor-shutter onto sleeve.

NOTE: Rough timing for starting may be established by centering nearest shutter wheel opening with optic detector on module.

There are three wires to be connected from the UNILITE distributor. Connect as follows:

Red Wire: Connect to + (positive) terminal of original coil. (This terminal may be marked BAT.)

NOTE: With Mallory 28675 Voltmaster coil, connect Red Wire to terminal of coil resistor NOT connected to Mallory coil.

Green Wire: Connect to - (negative) terminal of original coil. (This terminal may be marked DIST.)

Brown Wire: Connect to a good ground on engine. Clean any grease or paint away from engine block and stud. If brown wire is connected to coil hold-down bolt, be sure there is no paint or grease on bolt or engine block.

5. With distributor cap on distributor, the engine is now ready to start.
6. Use a timing light. Adjust initial timing at idle. Set timing as recommended by the engine manufacturer. For maximum performance and economy, advance timing so engine slightly pings under heavy load.

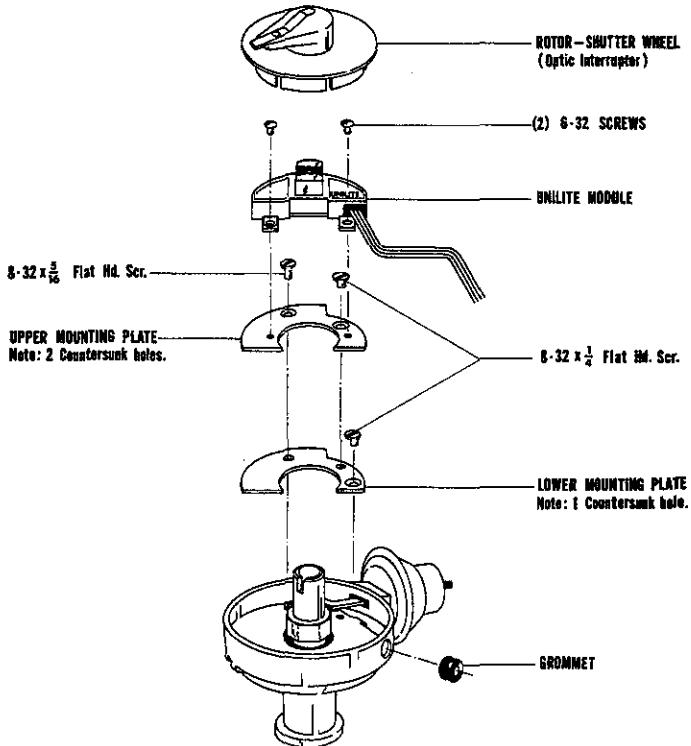


FIGURE A

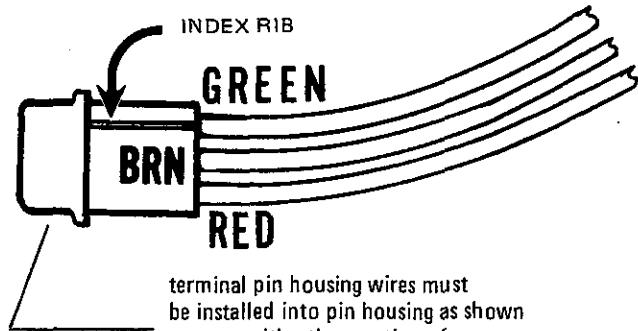


FIGURE B

KEEP THESE INSTRUCTIONS FOR FUTURE REFERENCE