State of California
AIR RESOURCES BOARD

EXECUTIVE ORDER D-47
Relating to Exemptions under Section 27156

CAMBRIDGE AUTOMOTIVE ENGINEERING INC.
"ALLISON OPTO-ELETRIC IGNITION SYSTEM"

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 39023 of the Health and Safety Code;

IT IS ORDERED AND RESOLVED: That the installation of "Allison Opto-Electric Ignition System" models 17 & 27 manufactured by Cambridge Automotive Engineering, Inc. 1269 E. Edna Place, Covina, California 91722 and marketed by Allison Automotive Company, P.O. Box 519, Baldwin Park, California 91706 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 1975 and older model year vehicles except as follows:

1) Those vehicles equipped with General Motors 6 cylinder engines.

2) Those vehicles equipped with Chrysler Corporation 6 or 8 cylinder engines.

3) Those vehicles equipped with Ford 8 cylinder engines.

4) Those vehicles originally equipped with breakerless ignition systems or dual point ignition systems where one of the points are used to retard timing for emission control.

5) 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).

This device consists of a light emitting diode and photocell sensor, a control rotor, and a transistor switching module.

This Executive Order is valid provided that installation instructions for this device will not recommend tuning the vehicle to specifications different than those listed by the vehicle manufacturer and the packaging container is clearly labeled to indicate specific vehicle applications for the unit.

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

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 "ALLISON OPTO-ELECTRIC IGNITION SYSTEM".

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 unlawful, untrue or misleading advertising, and Section 17534 makes violation punishable as a misdemeanor.

Sections 39130 and 39184 of the Health and Safety Code provide as follows:

> "39130. No person shall install, sell, offer for sale, or advertise, or, except in an application to the board for certification of a device, represent, any device as a motor vehicle pollution control device unless that device has been certified by the 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 section is a misdemeanor."
>
> "39184. (a) No person shall install, sell, offer for sale, or advertise, or, except in an application to the board for accreditation 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 accredited by the board. No person shall sell, offer for sale, advertise, or represent any motor vehicle pollution control device as an accredited device which, in fact, is not an accredited 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 8th day of ~~April~~ May, 1975

WILLIAM SIMMONS
Executive Officer

State of California

AIR RESOURCES BOARD

April 23, 1975

Staff Report

Evaluation of Cambridge Automotive Engineering Inc.
"Allison Opto-Electric Ignition System"

I. Introduction

Cambridge Automotive Engineering Inc. has submitted an application requesting an exemption from Section 27156 of the California Motor Vehicle Code for the "Allison Opto-Electric Ignition System". (Reference - Exhibit A and Amendment Exhibit B). Vehicle Code Section 27156 prohibits the installation of any device or mechanism which reduces the effectiveness of the required emission control devices. This vehicle code section also authorizes the Air Resources Board to exempt devices from this prohibition if a finding shows that the device will not adversely effect the performance of the emission control system. The applicant is requesting the exemption be granted for 1975 and older model year vehicles except as follows:

(1) Those vehicles equipped with General Motors 6-cylinder engines.

(2) Those vehicles equipped with Chrysler Corporation 6 or 8-cylinder engines.

(3) Those vehicles equipped with Ford 8 cylinder engines.

(4) Those vehicles originally equipped with breakerless ignition systems or dual point ignition systems where one of the points are used to retard timing for emission control.

(5) Those 1966-1970 vehicles equipped with "NOx retrofit devices" with a four degree retard in basic ignition timing (i.e. Carter, Echlin, STP Air Computer, Pure Power Electro-NOx.

II. System Description

The Allison Opto-Electric Ignition System is a unit to replace the breaker points within a distributor. It consists primarily of a control rotor, a position sensor, and a transistor switching unit. This device utilizes the ignition coil supplied with the vehicle. The window shutter or the control rotor is placed over the cam of the distributor and has windows cut for 8 cylinder, 6 cylinder or 4 cylinder engine applications. The position sensor operates in conjunction with the control rotor and consists of a light emitting diode and an infrared detector. The signals derived by the position sensor are then fed to the power unit which accomplishes transistor switching of the primary coil of the ignition system.

III. System Evaluation

The applicant did not submit any emission data indicating the device will not have any adverse effect on the emission control system. The applicant did submit data for the electrical characteristics of the unit. In order to evaluate the device, the electrical output characteristics of an ignition system with and without the device were compared. Tests were

conducted on the Air Resources Boards ignition system simulator which consists of a Sun distributor tester, Tektronix ocsilliscope, Sun ignition analyzer, and associated auxiliaries.

The ARB evaluation consisted of measuring the spark duration, available secondary voltage, secondary voltage rise time, the centrifugal and vacuum advance characteristics. The results of this comparison are shown in Table I.

Table I

Baseline Test - Simulator with Chrysler 8 cylinder 318 CID engine distributor and standard points.

Device Test - Simulator with above distributor--points removed and device installed.

Centrifugal Spark Advance in Crankshaft Degrees

RPM	Baseline Test	Device Test	Deviation from Baseline
600	0	0	0
1000	2	5 1/2	3 1/2 advance
1500	19	19	0
2000	21	20	1 retard
2500	23	23	0
3000	24	24	0

Vacuum Spark Advance in Crankshaft Degrees

Vacuum in. Hg.	Baseline Test	Device Test	Deviation From Baseline
0	0	0	0
5	0	0	0
10	2	1	1 Retard
15	20	11	9 Retard
20	20	11	9 Retard

Spark Duration in Microseconds

RPM	Baseline Test	Device Test
600	3000	2600
2000	2000	2500

Secondary Voltage Rise Time in Microseconds

RPM	Baseline Test	Device Test
600	30	20
2000	20	25

Cambridge Automotive Engineering Inc. was notified that the ARB test data on a Chrysler 318 distributor indicated a 9 degree retard in ignition timing from baseline due to a vacuum spark advance at 15 to 20 inches of mercury. This type of spark retard characteristic is generally experienced with position sensors on distributors designed by Chrysler and Ford where the pivot point of the breaker plate is eccentric to the distributor shaft rotor.

Cambridge Automotive Engineering Inc. then submitted an amendment to their application (Exhibit B) with a request for limited useage of their units. They also supplied data of vacuum advance characteristics comparing ignition timing of baseline and device equipped configurations for Ford, General Motors and Chrysler vehicles. A confirmatory test of the applicants data with a Ford 8 cylinder distributor was made at the ARB laboratory. The data of this confirmatory test is presented in Table II.

Table II

Baseline Test - Simulator with Ford 8 cylinder distributor and standard points.

Device Test - Simulator with above distributor--points removed and device installed.

Centrifugal Spark Advance in Crankshaft Degrees

Engine RPM	Baseline Test	Device Test	Deviation From Baseline
1200	5	4	1 retard
1600	8	6	2 retard
2000	11	9	2 retard
2400	15	13	2 retard
3000	19	17	2 retard

Vacuum Spark Advance in Crankshaft Degrees

Vacuum In. Hg.	Baseline Test	Device Test	Deviation From Baseline
3	0	0	0
5	1	0	1 retard
7	2	1	1 retard
9	7	3	4 retard
11	11	6	5 retard
13	15	8	7 retard
15	15	9	6 retard

Evaluation of the ARB data shows retard of basic timing greater than 4 crankshaft degrees, with the device installed on the Ford 8 cylinder vehicle. It should be noted that the Cambridge Automotive Engineering data presented in Exhibit B is reported in distributor degrees so that angular data should be doubled for evaluation in relation to crankshaft degrees.

The staff has established a maximum allowable retard of 4° (crankshaft) at sustained high speed operation. Excessive retard would be expected to increase exhaust gas temperature which may accelerate the deterioration rate of the exhaust valves. When the exhaust valves are sufficiently degraded, hydrocarbon emissions are expected to increase. If the timing is sufficiently retarded, CO emissions may also increase in some vehicles due to greater throttle opening which might cause the carburetor power jets to come into operation. In addition the change in throttle opening caused by retarded timing will lower the manifold vacuum and may upset the calibrations of the various vacuum operated emission control systems.

IV. Conclusion and Recommendations

Upon evaluation of the data generated at the Air Resources Board and at Cambridge Automotive Engineering, it was concluded that the Ford's 8 cylinder vehicles, General Motors 6 cylinder vehicles and Chrysler 6 and 8 cylinder vehicles should be excluded from this exemption.

It is also concluded that other exclusions from this exemption should be 1.) vehicles originally equipped with breakerless ignition systems or dual point ignition systems where one of the points are used to retard timing for emission control and 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).

The staff recommends that Cambridge Automotive Engineering Inc. be granted an exemption from the prohibitions of Section 27156 of the Vehicle Code for the "Allison Opto-Electric Ignition System" on 1975 and older model year vehicles except as noted.

CAMBRIDGE AUTOMOTIVE ENGINEERING INC.
5130 HEINTZ ST. BLDG. 7 BALDWIN PARK CA. 91706
(213) 338-3810

1269 E EDNA PLACE COVINA, CALIF 91722
(213) 339-4453

October 9, 1974

Mr. G. C. Hass
Air Resources Board
Vehicle Emissions Facility
9528 Telstar Avenue
El Monte, CA 91731

Dear Mr. Hass:

Cambridge Automotive Engineering, Inc. does here by submit, as per this letter, your form "Specifications - Ignition System" and related addendum to "Specifications - Ignition System", application to grant exemption from the prohibitions of Vehicle Code Section 27156, as it relates to our product Model Nos. 17 and 27. Applications requested for exemption are as follows: all single and duel point distributors except in those applications where the second set of points, in a duel set, serves as an emission control device. Use with NOX devises using a speed sensing circuit interfacing with the ignition system.

I apologize for the delay in submitting this application, but we are a small company and I have been in and out of the hospital since September 1 due to an accident.

Should you or anyone on your staff have questions regarding our application, I am at your disposal.

Sincerely,

Craig S. Beshore
President

CSB:mc

enclosure

EXHIBIT A

Addemdum - Specifications -
Ignition System

I. Manfacturer: Allison Automotive is the sales division of Cambridge Automotive Engineering, Inc.

Name and Model No.:

Model 17 - A complete conversion kit to breakerless ignition. Provides control over timing dwell and coil output characteristics.

Model 27 - For use as a triggering mechanism only for existing Electronic Ignition of a non-breakerless type. Controls timing and dwell only. Coil output is controlled by existing Electronic Ignition. Note: Electrical Specifications apply to Model 17 only.

II. All applications.

III. A. 1. All applications
B. 1. All applications
2. Standard Ford coil.
3. Standard Ford coil @ 14V.
4. Standard Ford coil @ 14V.

IV. Transient voltage protection (open circuits and voltage surges). Number and type of power transistor: See #V1.

EXHIBIT A

O.E.M. and device spark advance curves;

Centrifugal Advance

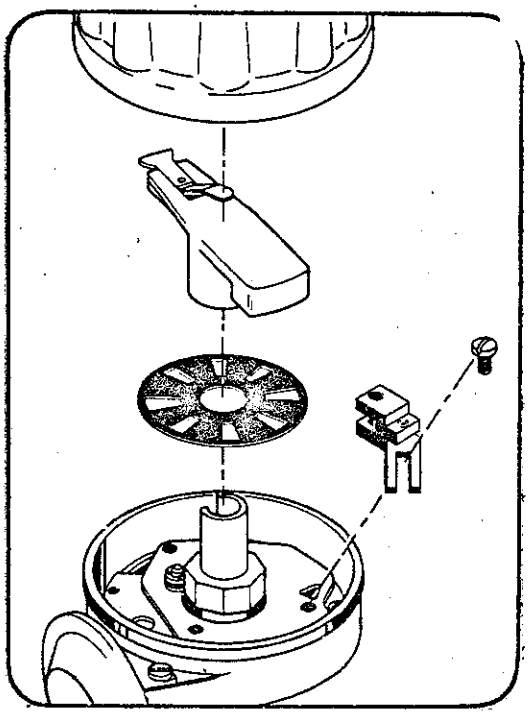
RPM	Allison Degrees Advance	O.E.M. (Points) Degrees Advance
1,000	6	6
2,000	7	7
4,000	11	10
6,000	11	10

Vacuum Advance

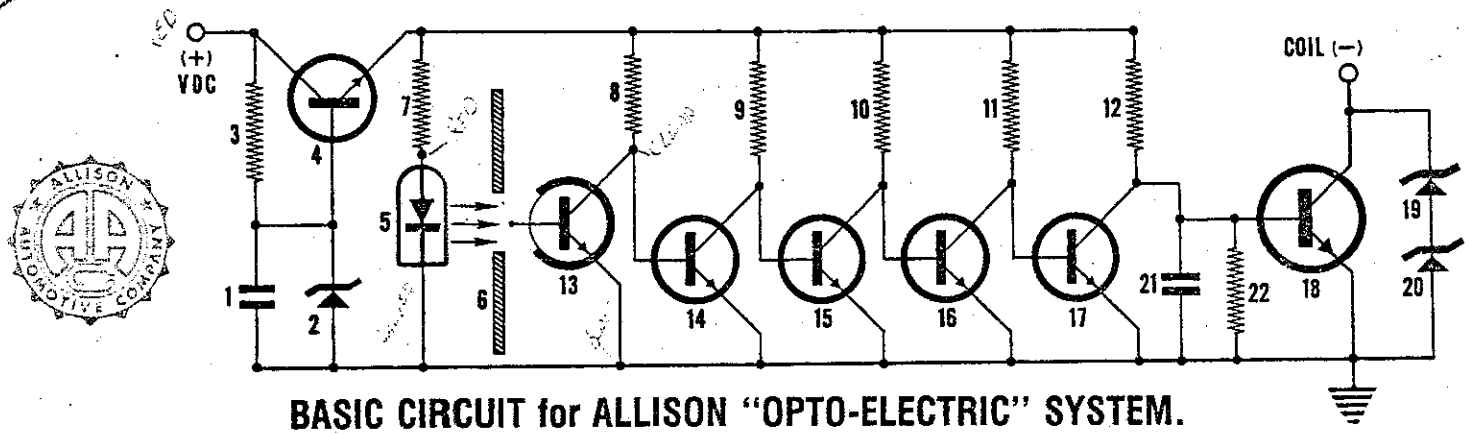
Inches Vacuum	Allison Degrees Advance	O.E.M. (Points) Degrees Advance
7	0	0
9	2	2
11	4	4
13	6	6
15	9	9
17	9	9

Spark advance measurements were made using a General Motors DC 802 (rebuilt) distributor on a Sun distributor machine. Vacuum advance measurements were made at 2,500 RPM.

V. Specify any other changes from O.E.M.



VI. Circuit diagram - description of operating principle:



BASIC CIRCUIT for ALLISON "OPTO-ELECTRIC" SYSTEM.

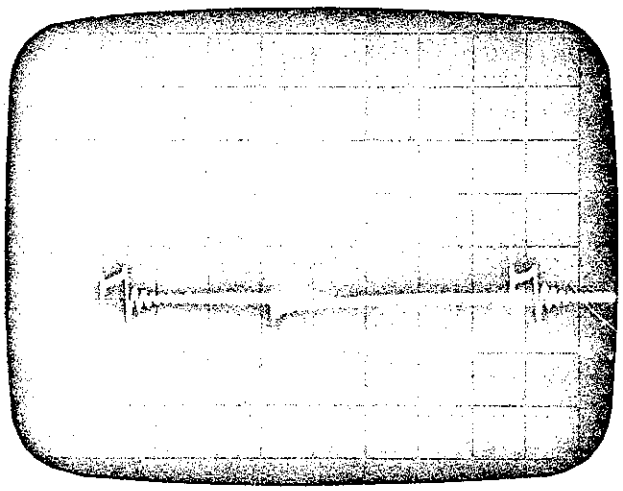
CIRCUIT OPERATION: Component #1, a Capacitor, works in conjunction with #2, a Zener-Diode, to Limit and Suppress spikes and transients in incoming Line-Voltage. Together with Resistor #3, and Transistor #4, they function as a REGULATED POWER SUPPLY for the rest of the Circuit. This eliminates any possible False-Triggering due to Transients or "Noise", and Prevents Timing Shift from changing Circuit Sensitivity due to fluctuating line-voltage. #7, #8, #9, #10, #11, and #12 are "Current Limiting" Resistors, which act to prevent damage to their respective Components. #5 is a LIGHT-EMITTING DIODE (LED). This is a Solid-State Device with an indefinite Life; that emits "Infrared-Light" which, when allowed to pass through the opening in the CONTROL-ROTOR #6, will Penetrate Grease, Water, Oil vapor...even thin cardboard...and cause the PHOTOTRANSISTOR #13, to Switch ON. #14, #15, and #16 are AMPLIFIER Transistors, operating in inverse for stability. When the Phototransistor #13, is "ON" it shunts the Base of #14, turning it OFF. The Base of #15 is no longer "Shunted" and it comes ON, turning #16 OFF, which turns the DRIVER Transistor #17, ON, shunting the final #18, causing it to go OFF. This STOPS the flow of Current in the Coil-Primary extremely FAST (Faster than possible with ANY Breaker-Point controlled system). This "Rapid Collapse" causes HIGHER than normal inducted voltage on the Primary, which means HIGHER Secondary OUTPUT. #19 and #21 are Zener Diodes which PROTECT the POWER TRANSISTOR #18 from damage by voltage spikes. #22 is a base-emitter Resistor which aids in Fast Switching and increases the voltage rating of the Transistor #18. #21 is a Capacitor which Prevents "Noise" from entering the Circuit through Radiation across the Collector-Base junction of the final #18.

All Transistors are "Silicon" for best Temperature-Rating.

EXHIBIT A

Spark Line:

@ 1,000 RPM 12 V.D.C.
Run Condition (ballast in)
Ford coil and ballast
Vert. @ 5KV/cm.
Horz. @ 5 millsec./cm.



INSTALLATION INSTRUCTIONS for the ALLISON OPTO-ELECTRIC IGNITION SYSTEM.

(Follow instructions carefully... as this will be your LAST maintenance on your ignition System).

BEFORE INSTALLATION: You must have the following information:

1. Proper Timing Setting (RPM and Degrees. Check Car Manual).
2. Be sure you know the correct Timing Procedure for your specific engine. (I.e., Most vacuum mechanisms should be disconnected and lines plugged.)

REPLACE faulty Spark-Plugs, Ignition Wires that are weak or more than two years old.

- DO NOT REMOVE THE BALLAST RESISTOR.

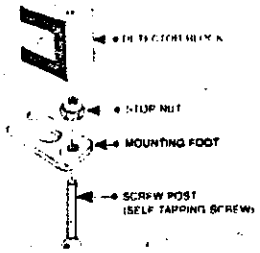
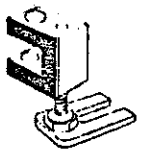


FIGURE #1.

TOOLS REQUIRED:
1. Timing Light.
2. Drill with 1/8" Bit, or Prick-Punch & Hammer.
3. Small (1/8") Screw-Driver.
4. Medium (5/16") Screw-Driver.
5. Open end Wrench ... 1/4 inch.
6. Wrench suitable for use on Distributor tie-down bolt.



BEFORE INSTALLATION:

1. Assemble Detector ... (see Figure #1). Pass Self-Tapping Screw through Foot and tighten in place with Elastic Stop-Nut (Nut with Nylon in hole). Hold Detector body stationary and screw Mounting Foot-Post (Self-Tapping Screw) into Detector Block approximately 3/4 of the way. (Final height adjustment will be made later)..
2. 6 and 8 Cylinders (ONLY)... Assemble Control-Rotor Disks using 2-56 x 1-3/8" Screws & Nuts. (G.M. and American Motors V-8 Rotors must be assembled later between Distributor Cam and the Advance Mechanism).
3. Attach the Wireclips to the Detector-Block (Figure #2) and position the Leads from the elements in the Block as shown, but DO NOT TIGHTEN the Clips or attach the Cable from the Power Module at this time.

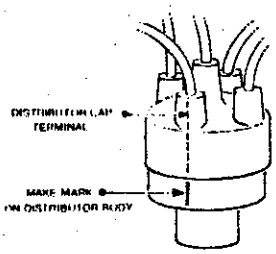


FIGURE #A.

TO INSTALL:

1. Make a vertical line (Using Pen, Paint, Chalk, Etc.) on the Distributor Body directly below any one of the Distributor-Cap Terminals. (Figure #A).
2. Remove Distributor-Cap, but leave High-Voltage Rotor in place.
3. Click engine over until tip of High-Voltage Rotor aligns directly OVER the vertical line on Distributor Body (Figure # B). Distributor Body may be rotated if necessary to achieve perfect alignment of High-Voltage Rotor with vertical line. Leave Distributor and High-Voltage Rotor in this position until Detector is installed.
4. Remove High-Voltage Rotor, Breakerpoints, Leadwire, and Condenser. (In the case of Dual Points, remove both sets). Keep Screws used to hold points, they will be used to hold Detector foot. (Shield Cover inside Distributor may be discarded, their purpose is to reduce radio interference from Point arcing, with elimination of the points, their function is unnecessary).
5. Wipe all grease and dirt from inside the Distributor, particularly the Cam Lobes and sides.
6. Slide the Control-Rotor onto the distributor Shaft (With Tabs down)... onto the Cam ... be sure the Rotor-Tabs are aligned with the Cam-Flats before pressing the Rotor Down. (Help spring the Tabs with a small screwdriver if necessary, but be careful not to deform them). (G.M. & A.M. V-8 Rotors must be assembled on the Distributor-Shaft between Cam and the Advance mechanism).
7. Set the Detector in the Distributor and determine the necessary height adjustment to be made (by screwing the Foot into the Block)... so that the Rotor will align in the middle of the slot in the Detector Block. Remove the Detector Block.
8. Pass the Gray Cable from the Power Module through leadwire hole in the Distributor Body. (If the existing grommet interferes with this Cable, remove the grommet). DO NOT mount the Power Module yet, pull approximately 2 feet of Cable through the Distributor hole.

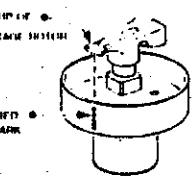


FIGURE #B.

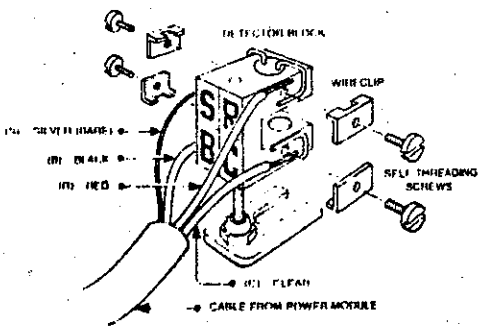
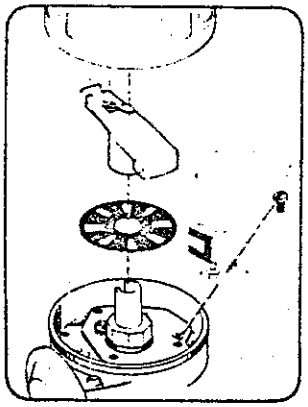


FIGURE #2.

9. Attach the stripped ends of the Cable-Wire underneath the Wireclips on the Detector Block (Figure #2). Note that the Fingers of the Wireclips go on the OUTSIDE of the Detector Block AWAY from the slot... DO NOT allow any portion of the Wireclip to protrude into the slot section. The Wireclips may have to be loosened slightly for insertion. Insert only the stripped portion of wire under the clip, NOT the insulated portion. The letters on the back of the Block correspond to the Color of the Cable wires. (Figure #2).

U.S. and Foreign PATENTS PENDING.

ALLISON AUTOMOTIVE COMPANY



10. Locate a vacant screw-hole in the Breaker-Plate in approximately the same location as previously occupied by the Points and as far from the Cam-Shaft as possible. Pass the gray Cable back out through the Distributor leadwire-hole until the length of the Cable remaining in the Distributor is just enough to allow for mounting and Breaker-Plate movement with the Detector at this hole. Angle the Foot so that its slotted portion is over this hole, and the Detector is directly OVER and aligned with any one of the Window-Openings in the Control Rotor. Tighten the Foot to the Breaker-Plate using one of the Screws left from removal of the Points.

If the Control-Rotor interferes with installation of this Screw... Remove the Rotor... install the Screw, snug, but do not tighten. Angle the Detector to one side so the Rotor can again be placed on the Cam. (See Figure #3).

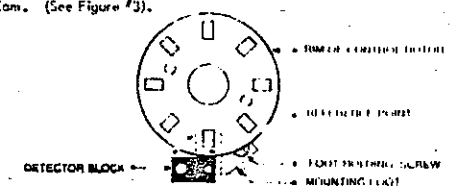
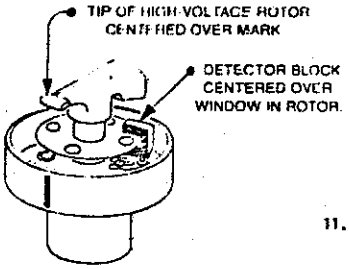


FIGURE #3.



FINAL ALIGNMENT

With the Detector angled as shown, move it toward the Rotor until the side of the Detector contacts the Rim of the Rotor. Carefully remove the Rotor WITHOUT changing the location of the Foot. Tighten the Foot holding Screw. Replace the Control-Rotor, and turn the Detector so that it points toward the Distributor-Shaft, and aligns directly over a window opening.

NOTE: Gradually rotate the Distributor-Rotor while looking into the windows in the Control-Rotor... check to be sure the windows expose the ENTIRE Element (round hole in slot of Detector). If not, it is necessary to align Detector unit so that the entire element is exposed by the window openings in the Control-Rotor.

11. Mount the Power Module ...where it will be exposed to as much cool airflow as possible. (Do not mount near exhaust system or on engine). The Module must be located so that the Cable to the Distributor is not in tension and not spliced. The Power-Module is "Chassis Grounded", and if not mounted on a metal surface a seperate Ground-Wire must be attached.

12. COIL CONNECTIONS: COMPLETE UNIT (Model #17). (See Figure #4).
- ● BLACK wire to Coil Negative (−). (DIST on some Coils).
- ○ RED wire to Coil Positive (+). (BATT on some Coils).

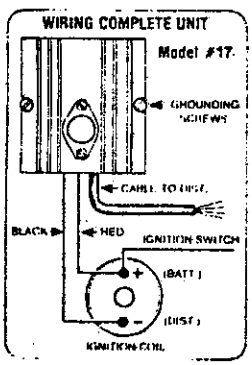


FIGURE #4.

Coil Connections: TRIGGER ONLY (Figure #5).
- ● POINT WIRE (from existing unit) to Stud on front of Module.
- ○ RED WIRE... join to same Terminal on Ignition Switch Lead.

13. Replace the High-Voltage Rotor. Click the engine over so that the Distributor-Shaft turns, and check the clearance between High-Voltage Rotor, Detector, and Control-Rotor. There should be NO contact or rubbing between the Detector and High-Voltage Rotor.

14. Replace Distributor-Cap, and High-Voltage Lead.

STARTING & TIMING THE ENGINE:

(A.) While cranking the Engine, slowly ROTATE the Distributor in either direction until the Engine starts and idles smoothly.

(B.) Turn engine OFF. Connect Timing-Light and time engine in accordance with conventional procedure. (Refer to Car Manufacturers recomendations).

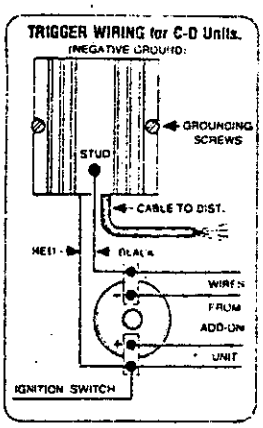


FIGURE #5.

☆ WARRANTY ☆

✱ ALLISON AUTOMOTIVE COMPANY will Repair or Replace, any Unit returned to the Address below postpaid, at NO CHARGE for PARTS or LABOR, for a Period of One Year from the date of Purchase. Units must be returned Complete (Power Module and Detector). Include your Name, Address, when Unit was purchased, and a brief description of the Problem.

This WARRANTY is in lieu of all Warranties or Guarantees expressed or implied. The Purchaser shall make sole judgement as to suitability of product use.

ALLISON AUTOMOTIVE CO.
P. O. Box 519, Baldwin Park, Cal 91706

NOTE: TRIGGER UNITS (Model #27)... may ONLY be used to Trigger C-D units. It will not operate the Ignition without the C-D unit connected. DO NOT therefore switch out or by-pass your C-D unit at any time.

CAMBRIDGE AUTOMOTIVE ENGINEERING INC.

1269 East Edna Place, Covina, CA 91722
(213) 339-4453

March 24, 1975

Air Resources Board
Vehicle Emissions Board
9528 Telstar Avenue
El Monte, CA 91731

Dear Sirs:

Please accept this letter as amendment to application to grant exemption from the prohibitions of Vehicle Code Section 27156 in behalf of Cambridge Automotive Engineering, Inc. as relates to our product model numbers 17 and 27.

Application requested for exemption are as follows; all single and dual point distributors except as follows:

1.) Second set of points in a dual set, serve as an emission control device.

		Model No.
2.) General Motors	(1) 6 cylinder	17-G.M.-6
Chrysler Corp.	(2) 8 cylinder	17-Chrysler-8
Chrysler Corp.	(2) 6 cylinder	17-Chrysler-6

(1) Includes Chevrolet, Oldsmobile, Pontiac, Buick, Cadillac
(2) Includes Dodge, Imperial, Plymouth

We sincerely hope that this amended application and the enclosed data will result in an exemption for our product.

If you have any questions or need further data please let me know.

Thank you for your time and consideration.

Sincerely,

Craig S. Beshore

Craig S. Beshore
President

CSB/mc

enclosure: Vacuum advance test data

Cambridge Automotive Engineering, Inc.
March, 1975

Company Confidentia

Distributor Test Data
ALL TESTS @ 600 RPM (engine)
Sun Distributor Test Machine Model 404

Δ°	MANUFACTURER	CYL.	ING. SYS.	5" MER.	10" MER.	15" MER.	20" MER.
3°	Ford	8	Points	3.5°adv.	8°adv.	10.5°adv.	11°adv.
		8	Opto	2°adv.	6°adv.	8°adv.	8°adv.
1°	Ford	6	Points	1°adv.	8°adv.	11°adv.	12°adv.
		6	Opto	1°adv.	6.5°adv.	10°adv.	11°adv.
2°	Ford	4	Points	1°adv.	7.5°adv.	7.5°adv.	7.5°adv.
		4	Opto	.5°adv.	5.5°adv.	5.5°adv.	5.5°adv..
5°	Gen. Mtrs.	6	Points	0°adv.	4°adv.	13.5°adv.	16°adv.
		6	Opto	0°adv.	3°adv.	8°adv.	9°adv.
2°	Gen. Mtrs.	4	Points	0°adv.	3°adv.	7°adv.	
		4	Opto	0°adv.	3°adv.	7°adv.	7°adv.
6.5°	Chrysler	8	Points	0°adv.	3°adv.	11°adv.	12°adv.
		8	Opto	0°adv.	2°adv.	5°adv.	5.5°adv.
6°	Chrysler	6	Points	0°adv.	7°adv.	15°adv.	15°adv.
		6	Opto	0°adv.	5.5°adv.	9°adv.	9°adv.