

State of California
AIR RESOURCES BOARD

EXECUTIVE ORDER D-198
Relating to Exemptions Under Section 27156
of the Vehicle Code

NUTRONICS CORPORATION
NU-CHARGE 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 Sections 39515 and 39516 of the Health and Safety Code and Executive Order G-45-5;

IT IS ORDERED AND RESOLVED: That the installation of the Nu-Charge system manufactured by Nutronics Corporation of 700 Weaver Park Road, Longmont, CO 80501, has been found not to 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 1989 and older model-year vehicles equipped with a 12-volt charging system.

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

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. Exemption of a kit shall not be construed as an exemption to sell, offer for sale, or advertise any component of a kit as an individual device.

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 NUTRONICS CORPORATION NU-CHARGE SYSTEM.

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

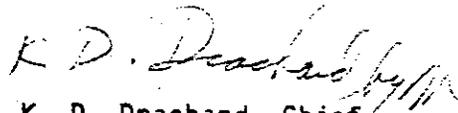
Section 17500 of the Business and Professions Code makes untrue or misleading advertising unlawful, and Section 17534 makes violation punishable as a misdemeanor.

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 El Monte, California, this 20th day of February, 1990.


K. D. Drachand, Chief
Mobile Source Division

State of California
AIR RESOURCES BOARD

EVALUATION OF NUTRONICS CORPORATION NU-CHARGE SYSTEM
FOR EXEMPTION FROM THE PROHIBITIONS OF VEHICLE CODE
SECTION 27156 IN ACCORDANCE WITH SECTION 2222, TITLE 13, OF THE
CALIFORNIA ADMINISTRATIVE CODE

February 1990

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by

Mobile Source Division
State of California
Air Resources Board
9528 Telstar Avenue
El Monte, CA 91731

(This report has been reviewed by the staff of the California Air Resources Board and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Air Resources Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.)

SUMMARY

Nutronics Corporation of 700 Weaver Park Road, Longmont, CO 80501, has applied for an exemption from the prohibitions of Vehicle Code Section (VC) 27156 for the Nu-Charge system. The Nu-Charge system is an electronic control unit which controls the alternator operation by disconnecting the alternator during acceleration or high speed cruising, but reconnecting the alternator when either the accelerator pedal is released or the battery voltage falls below a specified level. The applicant intends to market the device for 1989 and older model-year vehicles equipped with 12-volt charging systems.

Based on staff's engineering evaluation and results of tests performed by the Automobile Club of Southern California, the Nu-Charge system will have no adverse effect on emissions of the vehicles for which the exemption is requested. The staff recommends that Nutronics be granted a VC 27156 exemption for the Nu-Charge system as requested and that Executive Order D-198 be issued.

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EVALUATION OF NUTRONICS CORPORATION NU-CHARGE SYSTEM
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CALIFORNIA ADMINISTRATIVE CODE

I. INTRODUCTION

Nutronics Corporation of 700 Weaver Park Road, Longmont, CO 80501, has applied for a VC 27156 exemption in accordance with Section 2222, Title 13 of the California Administrative Code to market the Nu-Charge system for 1989 and older model-year vehicles equipped with a 12-volt charging system. The Nu-Charge system decreases engine load by disconnecting the alternator during inefficient operating regimes, but reconnecting the alternator when either the accelerator pedal is released or the battery voltage falls below a specified level. In theory, removing the alternator output while the engine is under load will reduce engine drag and improve fuel economy.

II. CONCLUSIONS

The applicant has submitted all the required information. Based on data from tests performed by the Automobile Club of Southern California and an engineering evaluation of the Nu-Charge device, the staff concludes that the device will have no adverse effect on emissions.

III. RECOMMENDATION

The staff recommends the exemption be granted to Nutronics Corporation as requested and that Executive Order No. D-198 permitting the advertisement, sales and installation of the Nu-Charge system be issued.

IV. NU-CHARGE SYSTEM DESCRIPTION AND OPERATION

The Nu-Charge system is a 4 by 3 by 2 inch electronic control unit, weighing about 9 ounces, that is wired into a vehicle's charging system and connected to a manifold vacuum source. Vacuum is used to signal this unit when to turn the alternator on or off. A red LED light indicates when the alternator is charging (LED light on) or not charging (LED light off).

The purpose of the Nutronics Nu-Charge system is to reduce parasitic losses caused by alternator loads during inefficient operating regimes. The Nu-Charge electrically disables the alternator during acceleration or high speed cruising, but reconnects the alternator when the accelerator pedal is released or when the battery voltage falls below a specified level. During alternator disconnect the vehicle runs on electricity from the battery. In normal city driving, deceleration is adequate to keep the battery fully charged. The Nu-Charge system is designed to prevent battery discharge to the point where it will affect engine starting.

V. DISCUSSION

Nutronics submitted all the required information for obtaining a VC 27156 exemption for the Nu-Charge system. Emission tests were performed on four vehicles by the Automobile Club of Southern California. There were two baseline and two device tests performed on the Buick Skyhawk and the Subaru GL, while three baseline and three device tests were performed on the Ford LTD and the Mercury Sable. The results of the tests are shown in Appendix A.

The tests showed that all four vehicles did not increase carbon monoxide (CO) or oxides of nitrogen (NOx) emissions. However, for the hydrocarbon (HC)

emissions, the 1988 Mercury Sable failed to meet the HC emission criteria (10% increase from baseline) by an 11.4% increase from the baseline. This is because HC emissions data from test #2, as shown in Appendix B, were not consistent with the results from other tests. HC emissions under tests #1 and #3 showed a negligible change from the baseline when tested with the device (-2.3%, and 0%, respectively), while that under test #2 showed a significant increase (33%). Test results under test #2 is also counter to the trend of no change or slight decrease in HC emissions exhibited by the other vehicles tested with the device installed. Based on these comparisons, data from test #2 was omitted resulting to an average change of 0% which is within the specified criteria.

Emission data from the four vehicles tested by the Automobile Club of Southern California has demonstrated that use of the Nu-Charge system will not cause vehicle emissions to increase significantly. Engineering evaluation conducted by the ARB staff also supports the test results. Thus, confirmatory testing by the ARB is unnecessary.

Based on the submitted data, the staff believes that the device does not violate the prohibitions in California Vehicle Code Section 27156. The staff recommends that Nutronics be granted a VC 27156 exemption for the Nu-Charge system as requested and that Executive Order D-198 be issued.

APPENDIX

APPENDIX A

Summarization of Test Data

		Device Off (g/mi)	Device On (g/mi)	% Change
1985 Buick	HC	0.53	0.53	0.0
Skyhawk	CO	8.88	7.88	-11.3
	NOx	0.46	0.45	-2.2
1987 Subaru GL	HC	0.155	0.125	-19.4
	CO	2.555	2.18	-14.7
	NOx	0.27	0.25	-7.4
1988 Ford LTD	HC	0.49	0.43	-12.2
Crown Victoria	CO	1.20	0.99	-17.3
	NOx	0.70	0.67	-4.3
1988 Mercury	HC	0.44	0.49	11.4
Sable Station	CO	1.76	0.92	-2.3
Wagon	NOx	0.84	0.92	9.5

APPENDIX B

LABORATORY TEST DATA FOR 1988 MERCURY SABLE STATION WAGON

TEST	HC (g/mi)	CO (g/mi)	NOx (g/mi)
Baseline #1	0.42	1.96	0.88
Baseline #2	0.36	1.22	0.81
Baseline #3	0.56	2.10	0.84
Device #1	0.41	1.76	0.91
Device #2	0.50	1.64	0.92
Device #3	0.56	1.77	0.92

ALTER-BREAK SYSTEM - MODEL A1400 - INSTALLATION INSTRUCTIONS

NOTE Identify your alternator/regulator system type before proceeding: The numbered instructions below are for alternators with "B circuit" external voltage regulators such as those on Ford with mechanical or electronic regulators, Toyota with mechanical regulators (which include E, F & N terminals), Bosch with external regulators (which include DF and D- terminals), 1961-1969 Chrysler Corporation with mechanical regulators and other systems with "B circuit" regulators that control the positive (+) side of the field windings.

For alternators with "A circuit" regulators such as 1970-1987 Chrysler Corporation vehicles with electronic regulators, the attachment of the terminals "A" and "B" in the accompanying diagram **MUST BE REVERSED**. MALE terminal "B" must be installed on the stripped wire leading FROM the regulator field terminal and the FEMALE receptacle terminal "A" must be installed on the stripped wire leading TO THE ALTERNATOR FIELD TERMINAL.

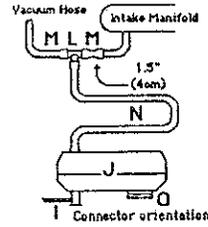
1. TURN OFF IGNITION!!! TURN OFF IGNITION!!! TURN OFF IGNITION!!!
 2. CAUTION: PLACE WHEEL CHOCKS IN FRONT AND BEHIND THE DRIVING WHEELS AND FIRMLY SET THE EMERGENCY BRAKES BEFORE CONTINUING.
 3. Locate the FIELD TERMINAL WIRE between the alternator and regulator and cut the wire in an area accessible for stripping and terminating.
 4. Strip 5/16 (8mm) insulation off each end of the wire cut in step 3.
 5. Install the FEMALE RECEPTACLE TERMINAL A on the stripped wire leading FROM THE REGULATOR and crimp firmly with a crimping tool.
 6. Install the MALE TERMINAL B on the stripped wire leading FROM THE ALTERNATOR FIELD TERMINAL and crimp firmly.
 7. Plug the BLUE wire C of the ALTER-BREAK SYSTEM (ABS) harness into the female receptacle A installed in step 5 and plug the male receptacle B installed in step 6 into the female receptacle D attached to the YELLOW wire of the ABS harness.
 8. Locate a POSITIVE (+) wire near the Battery and within reach of the partially connected ABS wiring harness and attach one of the QUICK TAP-IN assemblies E.
 9. Locate an IGNITION KEY-SWITCHED power wire within reach of the ABS wiring harness and attach the other QUICK TAP-IN assembly F on the SWITCHED wire.
 10. Plug the RED ABS harness wire G into the POSITIVE + receptacle E attached in step 8.
 11. Plug the BLACK ABS harness wire H into the SWITCHED receptacle F attached in step 9.
 12. Plug the 8 terminal ABS wiring connector I into the back of the ABS case J. **NOTE THAT THE CORRECT ORIENTATION OF THE CONNECTOR HAS THE WIRES EXTENDING AWAY FROM THE CASE AND NOT CROSSING OVER THE CASE.**
 13. Locate a good chassis ground source (B-) and attach the terminal K of the GREEN ABS wire to that source.
 14. Locate a vacuum line M **CONNECTED TO THE INTAKE MANIFOLD**, cut the vacuum line M 1.5 inches (4cm) from the manifold fitting and install the vacuum tee fitting L provided, in series with the vacuum line M (JUST CUT) and the Intake manifold.
 15. Attach one end of the vacuum line N provided to the short leg of the tee L and attach the other end to the nozzle located on the front of the ABS case J.
 16. Start and warm up the engine and **VERIFY YOU ARE POSITIVELY CONNECTED TO THE MANIFOLD VACUUM** by disconnecting the vacuum line N from the front of the ABS case J. WITH THE ENGINE RUNNING, you should be able to pick up a small coin such as a penny or a nickel with the end of the vacuum hose N. **AT THIS POINT, QUICKLY STEPPING ON AND RELASING THE ACCELERATOR PEDAL SHOULD MAKE THE COIN DROP OFF THE END OF THE VACUUM HOSE.** If verification is positive, re-connect the vacuum hose N to the ABS.
 17. THOROUGHLY CLEAN AND DE-GREASE a smooth, cool, flat surface within reach of the ALTER-BREAK SYSTEM and harness assembly.
 18. Peel off the protective strip from one side of the hook and loop fastener O provided and press on to the back of the ABS unit J, peel the strip off the other side of the fastener and press the ABS unit onto the flat surface prepared in step 17.
 19. Turn on the lights and adjust the ABS load sensor by tightening the adjustment screw in the center of the case in the clockwise direction until the red light (LED) in the lower left corner of the case turns off and loosen the screw in the counter-clockwise direction until the LED (Light) turns back on and CONTINUE TURNING AN ADDITIONAL 1/2 TURN. THE ENGINE SHOULD SPEED UP WHEN THE LED IS OFF AND SLOW DOWN WHEN THE LED IS ON. When the LED is on, the alternator is in the normal charging mode and when it is off such as during acceleration the alternator is totally or proportionally disengaged depending on the status of the battery.
- NOTE:** During acceleration or with the engine under load, AND WITH THE BATTERY ALMOST FULLY CHARGED the battery charging INDICATOR LIGHT MAY GLOW. THIS IS A POSITIVE INDICATION that the ABS unit is operating correctly and helping to conserve energy as well as providing additional power during acceleration. A second method of verifying the installation is by observing the brightness of the HEADLIGHTS which MAY DIM SLIGHTLY during acceleration and brighten during deceleration indicating normal ABS operation. If the vehicle is equipped with a voltage or amp meter, the voltage readings will drop approximately two volts or the amp meter will swing towards low charge during acceleration and back up during low engine load.

NUTRONICS CORPORATION

700 Weaver Park Road, Suite A • Longmont, Colorado 80501 • (303) 678-5553

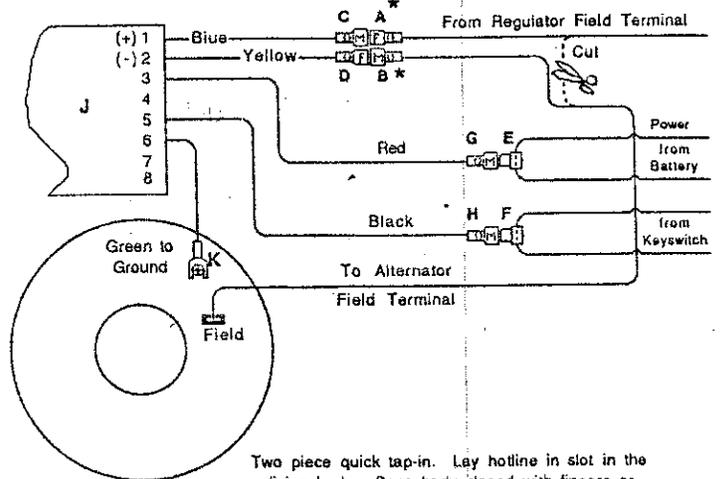
A3214 Tue, Jun 14, 1988

ALTER-BREAK MODEL A1400
WIRING DIAGRAM for
Vehicles with
Externally Regulated Alternators



This diagram is for "B CIRCUIT" regulators such as those on Ford.

* For "A CIRCUIT" regulators such as those on 1970-1987 Chrysler, the location of terminals "A" and "B" MUST BE SWITCHED.

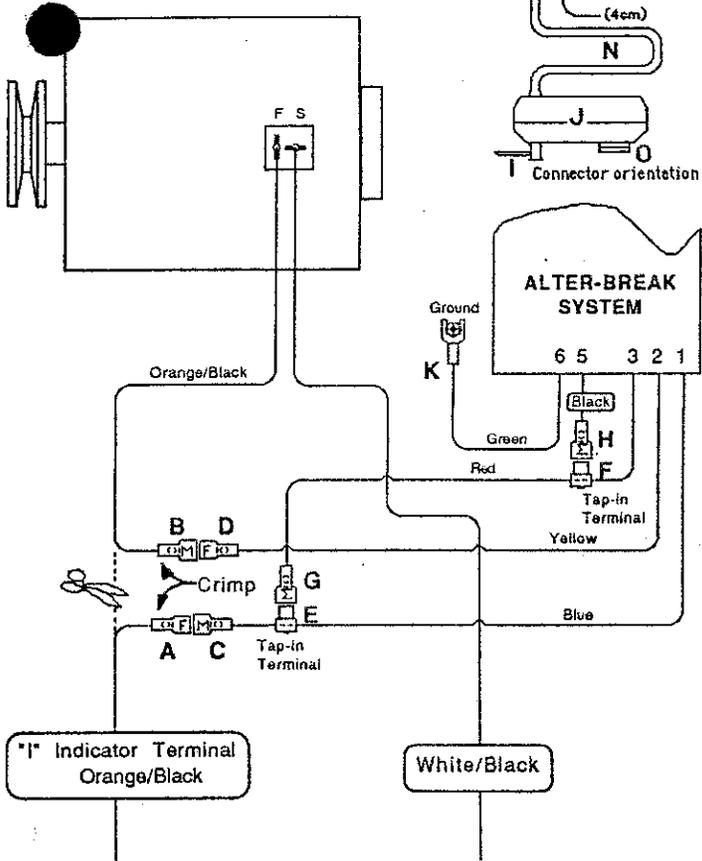


Two piece quick tap-in. Lay hotline in slot in the splicing body. Snap body closed with fingers or pliers to make an insulated receptacle for a standard terminal. Tap-in line may be quickly connected or disconnected. No wire cutting or insulation stripping required for these two connections.

A3233 6/21/88

Sable/Taurus

(INTEGRAL ALTERNATOR-REGULATOR UNIT)

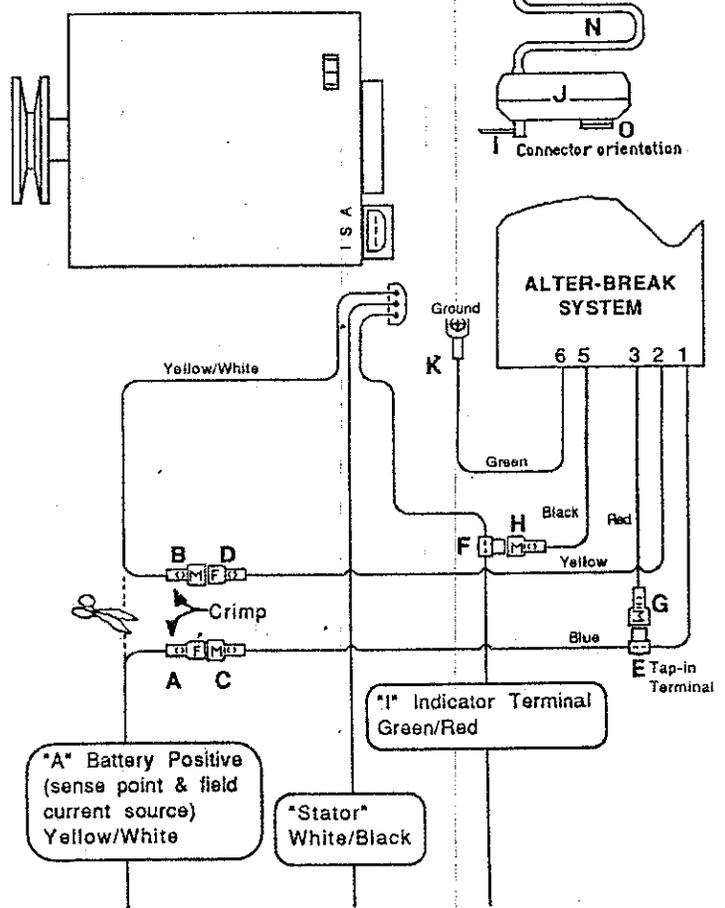


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FORD IAR

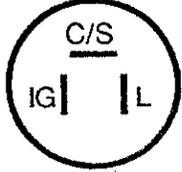
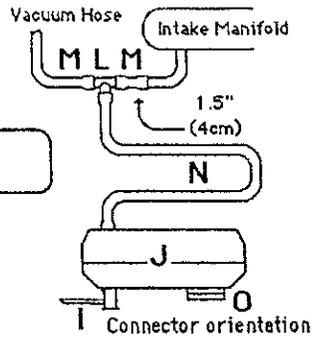
(INTEGRAL ALTERNATOR-REGULATOR UNIT)



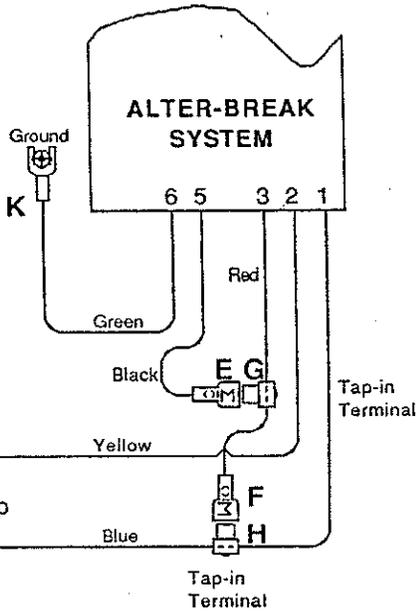
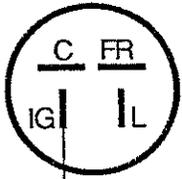
A3234

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TOYOTA



Alternator Connector

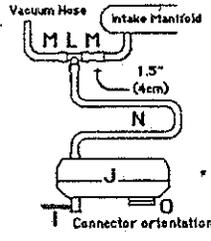
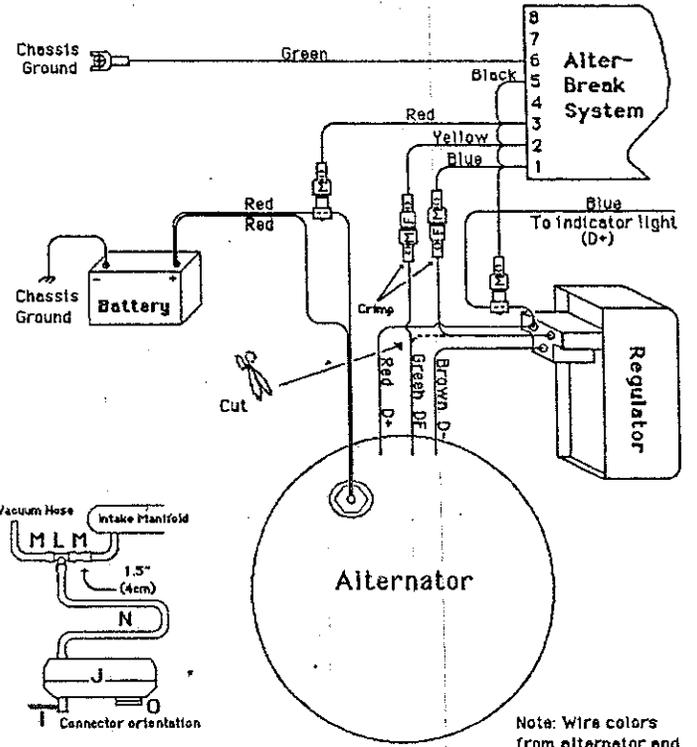


To Wiring Harness

A3225

6/23/88

Installation on Bosch - External Regulator



Note: Wire colors from alternator and regulator may vary.

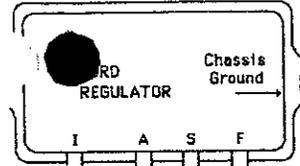
A3220 6/20/88

FORD External Ammeter or Warning Light

SEPARATE RELAY-TYPE REGULATORS

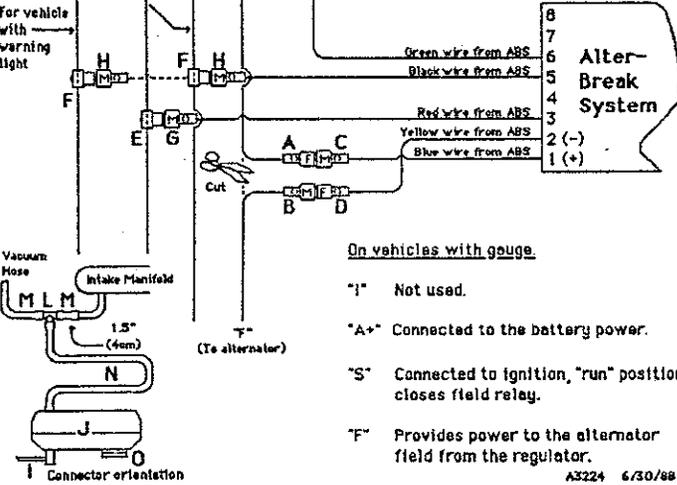
On vehicles with indicator lamp.

- "I" is powered by the indicator lamp and is used for initial excitation of the alternator.
- "A+" is connected to the battery power at all times and powers the regulator.
- "S+" is powered by the alternators "stator" tap or "stator" terminal and closes the field relay.
- "F" Provides power to the alternator field from the regulator.



For vehicle with
Ammeter

For vehicle with
warning
light

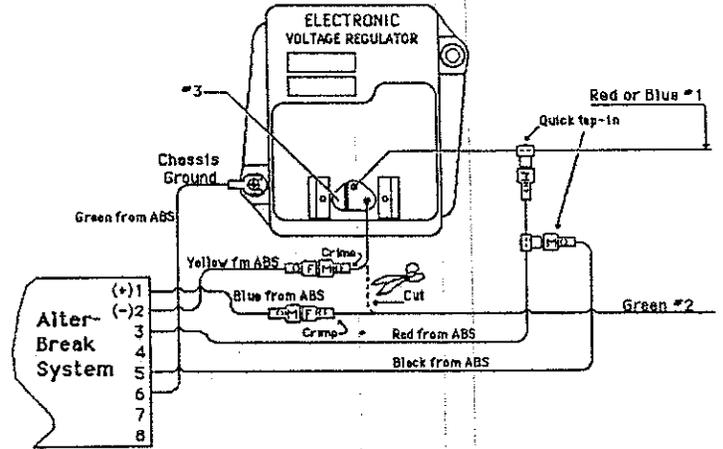


On vehicles with gauge.

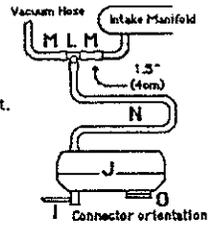
- "I" Not used.
- "A+" Connected to the battery power.
- "S" Connected to ignition, "run" position closes field relay.
- "F" Provides power to the alternator field from the regulator.

A3224 6/30/88

CHRYSLER 1970-1986



- *1. Blue or red. This terminal provides battery power to the regulator whenever the ignition switch in the "run" position.
- *2. Green. This terminal gets its power from the alternator field to the regulator. The regulator then "grounds" this wire to bring the alternator to full output.
- *3. This terminal was only used on the 1969 Imperial and only the two prong is currently being used.



A3227

6/30/88