

State of California
AIR RESOURCES BOARD

EXECUTIVE ORDER D-129
Relating to Exemptions under Section 27156
of the Vehicle Code

THE GOODMAN SYSTEM COMPANY, INC.
THE GOODMAN 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 Goodman System manufactured by Goodman System Company, Inc. 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 1983 and older model-year vehicles, except for the following:

1. All diesel engines.
2. General Motors' variable displacement 8-6-4 engines.
3. Vehicles which are not normally equipped with an air injection pump.
4. Vehicles originally equipped with closed-loop feedback carburetors.

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 GOODMAN 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.

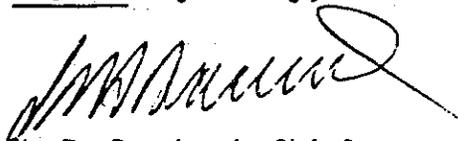
Section 17500 of the Business and Professions Code makes untrue or misleading advertising unlawful, and Section 17534 makes violation punishable as a misdemeanor.

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 2nd day of May, 1983.


K. D. Drachand, Chief
Mobile Source Control Division

State of California
AIR RESOURCES BOARD

EVALUATION OF THE GOODMAN SYSTEM COMPANY, INC.'S
"GOODMAN SYSTEM" WATER INJECTOR FOR EXEMPTION
FROM THE PROHIBITIONS OF VEHICLE CODE SECTION 27156

April, 1983

State of California
AIR RESOURCES BOARD

EVALUATION OF THE GOODMAN SYSTEM COMPANY, INC.'S "GOODMAN SYSTEM" WATER
INJECTOR FOR EXEMPTION FROM THE PROHIBITIONS OF VEHICLE CODE SECTION 27156

by

Mobile Source Control 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

The Goodman System Company, Inc. has requested exemption from the prohibitions of Vehicle Code Section 27156 for the Goodman System, a water injector device. Two previous applications were denied because of increased emissions from test vehicles with the use of the device. The manufacturer then modified the design of the device twice. The device in its present configuration has shown, through comparative emission testing, no effect on the operation and the performance of OEM emission controls. The test data also show no effect on fuel economy with the use of the device.

The staff, therefore, recommends adoption of Executive Order D-129 since no adverse emissions impact was found.

TABLE OF CONTENTS

	<u>Page Number</u>
<u>SUMMARY</u>	i
<u>TABLE OF CONTENTS</u>	ii
I. <u>INTRODUCTION</u>	1
II. <u>CONCLUSIONS</u>	1
III. <u>RECOMMENDATION</u>	2
IV. <u>SYSTEM DESCRIPTION AND EVALUATION</u>	2
V. <u>DISCUSSION</u>	5
VI. <u>FIGURE 1</u>	6

State of California
AIR RESOURCES BOARD

EVALUATION OF THE GOODMAN SYSTEM COMPANY, INC.'S "GOODMAN SYSTEM" WATER
INJECTOR FOR EXEMPTION FROM THE PROHIBITIONS OF VEHICLE CODE SECTION 27156

I. INTRODUCTION

The Goodman System Company, Inc. of New York, NY 10022 has applied for an exemption from the prohibitions of Vehicle Code Section 27156 for an add-on water injector device known as the "Goodman System". Exemption is sought for 1983 and older model-year vehicles, except for the following:

- i) All diesel engines.
- ii) General Motors' variable displacement 8-6-4 engines.
- iii) Vehicles which are not normally equipped with an air injection pump.
- iv) Vehicles originally equipped with closed-loop feedback carburetors.

The Goodman System uses compressed air from the air injection pump ("smog pump") to spray water through a nozzle into the carburetor's air horn.

Two early Goodman System models, the first and the second generation model, caused adverse emission problems, and the exemption applications were denied. The current application for the third generation model was accompanied with data from comparative exhaust emission tests of two 1983 model-year vehicles.

II. CONCLUSIONS

The submitted comparative exhaust emission data from the two 1983 model-year vehicles illustrate no adverse emissions impact with the use of the third generation Goodman System. The data also shows that the fuel economy of the test vehicles was not affected with the use of the device.

III. RECOMMENDATION

Since the device does not show an adverse emission effect, the staff recommends that the third generation Goodman System be exempted from the prohibitions of Vehicle Code Section 27156 for the vehicles as requested. The staff recommends the adoption of Executive Order D-129.

IV. SYSTEM DESCRIPTION AND EVALUATION

A. SYSTEM DESCRIPTION

The "Goodman System" consists of a spray nozzle, a load sensor, an air pump tap, a check valve, a temperature switch, a water reservoir bag, and connective tubings (See Figure 1.)

The metal spray nozzle is connected to the air supply and water reservoir. It is installed in the air cleaner housing. The orifice sizes of the nozzle vary from 0.012" to 0.022" for use on different sizes of engines. The load sensor is basically a bypass valve. It directs air flow from the air pump to the nozzle. During high manifold vacuum engine operating modes, the diaphragm in the valve is pulled down by the vacuum force allowing air to escape to the atmosphere. The load sensor is pre-adjusted (and sealed) by the manufacturer to prevent excessive water injection during high vacuum modes. The air pump tap is a plastic tee with a hose fitting protruding from its center at a right angle. It is simply installed by removing a small section of the rubber pressure hose in the secondary air injection system and inserting the tap in its place. The tap is then secured by two screw clamps. The temperature sensor/switch is installed in the air cleaner housing and prevents the device from functioning until the underhood air temperature is above 60°F.

The third generation Goodman System includes a modification to the device's air pump tap to reduce the delivery pressure and, therefore, the amount of air to the load sensor. The amount of water injection is expected to be proportionally reduced. The modification involved the removal of a restriction in the tap so that the designed secondary air supply to the engine will not be markedly changed.

In operation, air, under pressure from the air pump, is supplied through the load sensor to the spray nozzle located in the air cleaner housing directly over the carburetor's air horn. The flow of air creates a low pressure area at the nozzle orifice allowing water to be drawn from the reservoir. As the water enters the air stream, it is atomized and the air/water mixture is drawn into the carburetor and, subsequently, along with the air/fuel mixture into the engine cylinders. The load sensor is preset to cut off the air supply (venting to atmosphere) to the nozzle during high vacuum engine operation periods, thereby preventing water from being drawn from the reservoir.

The applicant claims that the system will deliver 10-12 percent water (in the air/fuel mixture) during accelerations (low manifold vacuum), 3-5 percent water during cruise conditions (moderate manifold vacuum), and no water during idle and decelerations (high manifold vacuum).

B. SYSTEM EVALUATION

In order for the applicant to demonstrate compliance of the third generation device with the "no emission increase" requirements, two vehicles were selected for testing.

The applicant delivered the vehicles to the Southern California Automobile Club's emission laboratory for comparative CVS-75 exhaust emissions tests. The test vehicles are described in Table 1, and the comparative emission test results are shown in Table 2.

Table 1
Applicant's Test Vehicle/Descriptions

<u>Description</u>	<u>Vehicle 1</u>	<u>Vehicle 2</u>
Year	1983	1983
Make	Ford	Mercury
Model	Escort	Zephyr
Engine Size	1.6L, I-4	3.3L, I-6
Emission Control	AIR, EGR, TWC	AIR, EGR, TWC
Carburetor Type	2V	IV
Odometer Mileage	2.9K	4.8K

Table 2
Applicant's Comparative CVS-75 Emission Results

<u>Vehicle</u>	<u>Exhaust Emissions (gm/mi)</u>			<u>Fuel Mileage (MPG)</u>
	<u>HC</u>	<u>CO</u>	<u>NOx</u>	<u>Urban & Highway Combined</u>
#1 Baseline	0.6	9.9	0.9	25.2
#1 Device	0.6	10.6	0.8	24.3
#2 Baseline	0.6	4.1	0.5	19.5
#2 Device	0.5	3.2	0.6	19.1
1983 Std.	0.41	7.0	0.7	

The Air Resources Board did not perform confirmatory testing of the third generation Goodman System.

V. DISCUSSION

The applicant's comparative emission data were reviewed by the staff. The differences in HC and NOx emission values between the paired baseline/device tests were considered to be within the limits of test variability; there were no measurable changes in HC and NOx emissions from the baseline levels due to the use of the device. The CO emissions changed slightly; there was an increase for test vehicle No. 1 and there was a decrease for test vehicle No. 2. The increase for test vehicle No. 1 was insignificant.

It should be noted that both test vehicles exceeded at least one of the applicable exhaust emission standards. However, no obvious defects were found.

Each of the vehicles tested has emission controls, which are sensitive to any changes in engine operating parameters caused by the installation/use of the device. It is evident from the test results that the device did not affect the operation and the performance of these emission controls.

The applicant also performed testing with only the air pump tap installed to demonstrate that the amount of reduction in the secondary air supply to the engine would not affect exhaust emissions. The test data was reviewed by staff, and no emissions changes were found.