

State of California
AIR RESOURCES BOARD

EXECUTIVE ORDER D-231-7
Relating to Exemptions Under Section 27156
of the Vehicle Code

WHIPPLE INDUSTRIES, INC.
GM WHIPPLECHARGER KITS

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 GM Whipplecharger kits listed in Exhibit 1, manufactured by Whipple Industries, Inc. of 3292 North Weber, Fresno, California 93722, have been found not to reduce the effectiveness of the applicable vehicle pollution control system and, therefore, is exempt from the prohibitions of Section 27156 of the Vehicle Code for installation on selected 1994 to 1995 General Motors (GM) vehicles that are not equipped with an on-board-diagnostics II system (OBD II) as listed in Exhibit 1, which is attached hereto and incorporated herein.

This Executive Order is valid provided that installation instructions for the GM Whipplecharger kits, will not recommend tuning the vehicle to specifications different from those of the vehicle manufacturer.

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

Marketing of the superchargers using any identification other than that shown in this Executive Order or marketing of the supercharger 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 the use of the supercharger may have on any warranty either expressed or implied by the vehicle manufacturer.

This Executive Order is granted based on comparative intake manifold air pressure that was recorded during a Hot-Start 505 LA4 drive cycle in the baseline and modified configuration. Test data showed that the Whipplecharger did not operate during the Hot-Start 505 drive cycle and thus could not affect the emissions of the vehicle. However, the ARB finds that reasonable grounds exist to believe that use of the GM Whipplecharger kits listed in Exhibit 1 may adversely affect emissions of motor vehicles when operating under conditions outside the parameters of the previously prescribed test procedures. Accordingly, the ARB reserves the right to conduct additional emission tests, in the future, as such tests are developed, that will more adequately measure emissions from all cycle phases. If such test results demonstrate that the GM Whipplecharger kits

listed in Exhibit 1 adversely affect emissions during off-cycle conditions (defined as those conditions which are beyond the parameters of the Cold-Start CVS-75 Federal Test Procedure), this Executive Order shall be effectively rescinded as of the date the test results are validated. Further, if such test results or other evidence provides the ARB with reason to suspect that the GM Whipplecharger kits listed in Exhibit 1 will affect the durability of the emission control system, Whipple Industries, Inc. shall be required to submit durability data to show that the durability of the vehicle emission control system is not, in fact, affected and/or that the add-on or modified part demonstrates adequate durability.

In addition to the foregoing, the ARB reserves the right in the future to review this Executive Order and the exemption provided herein to assure that the exempted add-on or modified part continues to meet the standards and procedures of Title 13, California Code of Regulations, Section 2222, et seq.

THIS EXECUTIVE ORDER DOES NOT CONSTITUTE A CERTIFICATION, ACCREDITATION, APPROVAL, OR ANY OTHER TYPE OF ENDORSEMENT BY THE AIR RESOURCES BOARD OF CLAIMS OF THE APPLICANT CONCERNING ANTI-POLLUTION BENEFITS OR ANY ALLEGED BENEFITS OF WHIPPLE INDUSTRIES, INC.'S GM WHIPPLECHARGER KITS.

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.

Violation of any of the above conditions shall be grounds for revocation of this order. The order may be revoked only after ten day written notice of intention to revoke the order, in which period the holder of the order may request in writing a hearing to contest the proposed revocation. If a hearing is requested, it shall be held within ten days of receipt of the request and the order may not be revoked until a determination after hearing that grounds for revocation exist.

Executed at El Monte, California, this 22nd day of March, 1995.

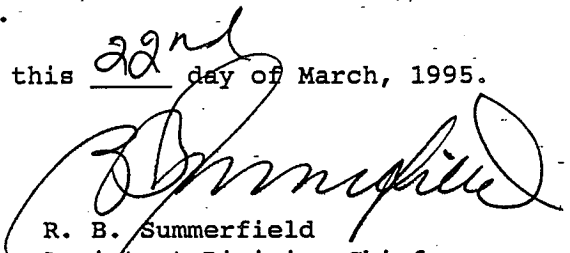

R. B. Summerfield
Assistant Division Chief
Mobile Source Division

Exhibit 1

Whipple Supercharger Kits
Part Number List
E.O. D-231-7

<u>Part Number</u>	<u>Vehicle Application</u>
(all models except those equipped with OBD II)	
<i>Tier 0 Vehicles</i>	
3116944-S	1988-94 GM 4.3 liter S-10 models
3116944-C	1988-94 GM 4.3 liter C/K models
3116954-HD*	1988-95 GM 4.3 liter C/K HD (1995 MD**) models
3133895-C	1989 GM 5.0/5.7 liter C/K models
3133915-C	1990-91 GM 5.0/5.7 liter C/K models
3133945-C	1992-94 GM 5.0/5.7 liter C/K models
3133955-HD*	1988-95 GM 5.0/5.7 liter C/K HD (1995 MD**) models
3150907-C	1990 GM 7.4 liter C models
3150937-C	1991-93 GM 7.4 liter C models
3150937-HD*	1988-93 GM 7.4 liter C/K HD models
3150957-HD*	1994-95 GM 7.4 liter C/K HD models
<i>Tier 1 Vehicles</i>	
3116944-S1	1994-95 GM 4.3 liter S-10 models
3116944-C1	1994-95 GM 4.3 liter C/K models
3133945-C1	1994-95 GM 5.0/5.7 liter C/K models

* HD - Heavy Duty Vehicles

** MD - Medium Duty Vehicles

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AIR RESOURCES BOARD

EVALUATION OF WHIPPLE INDUSTRIES, INC.'S
GM WHIPPLECHARGER KITS FOR EXEMPTION FROM THE PROHIBITIONS OF
VEHICLE CODE SECTION 27156 IN ACCORDANCE WITH SECTION 2222, TITLE 13, OF THE
CALIFORNIA CODE OF REGULATIONS

March 1995

State of California
AIR RESOURCES BOARD

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CALIFORNIA CODE OF REGULATIONS

by

Mobile Source Division
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(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

Whipple Industries, Inc. (Whipple) of 3292 North Weber, Fresno, California 93722, has requested that Executive Order D-231-5, which exempts Whipple's GM Whipplecharger kits for 1994 and earlier model year General Motors vehicles equipped with throttle body fuel injection as listed in Appendix B, from the prohibitions in Section 27156 of the California Vehicle Code (VC), be updated to include the 1994 and 1995 model year vehicles listed in Appendix A.

Whipple Industries, Inc. has forwarded installation instructions and Whipplecharger functional specifications and operation description. Whipple Industries, Inc. also performed comparative intake manifold air pressure tests at California Environmental Engineering Laboratory in Santa Ana, California. A 1995 C1500 4.3L General Motors truck, certified to tier one emission levels with the Whipplecharger kit number 3116944-C1 installed was used as the test vehicle.

Based on the submitted information which includes comparative intake manifold air pressure tests, system and operation description, and previous emissions testing conducted by Whipple, the staff concludes that the superchargers will not adversely affect exhaust emissions from the vehicles for which an exemption is requested.

The staff recommends that Whipple Industries, Inc. be granted an exemption as requested and that Executive Order D-231-7 be issued.

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EVALUATION OF WHIPPLE INDUSTRIES, INC.'S
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VEHICLE CODE SECTION 27156 IN ACCORDANCE WITH SECTION 2222, TITLE 13, OF THE
CALIFORNIA CODE OF REGULATIONS

I. INTRODUCTION

Whipple Industries, Inc. (Whipple) of 3292 North Weber, Fresno, California 93722, has requested that Executive Order D-231-5, which exempts Whipple Industries, Inc.'s supercharger kit from the prohibitions in Section 27156 of the California Vehicle Code (VC) on selected 1994 and earlier model-year General Motors (GM) vehicles equipped with throttle body fuel injection as listed in Appendix B, be updated to include the 1994 and 1995 model-year vehicles listed in Appendix A.

Whipple Industries, Inc. has stated that the GM Whipplecharger kit is the same as that certified in E.O. D-231-5. Whipple also performed comparative intake manifold air pressure tests at California Environmental Engineering in Santa Ana, California, on a 1995 4.3L Chevrolet C1500 full size truck, certified to tier 1 emission levels with Whipplecharger kit # 3116944-C1 installed.

II. CONCLUSIONS

Based on the submitted information which includes comparative intake manifold air pressure tests and the system description and operation, as well as previous emissions testing conducted by Whipple Industries, Inc., the staff concludes that the GM Whipplecharger kits will not adversely affect exhaust emissions from the vehicles for which an exemption is requested.

III. RECOMMENDATION

The staff recommends that Whipple Industries, Inc. Products, Inc. be granted an exemption for the kits listed in Appendix 1. The staff also recommends that Executive Order D-231-7 be issued.

IV. GM WHIPPLECHARGER DESCRIPTION

The Whipple Industries, Inc.'s GM Whipplecharger kits are designed for installation on selected 1988 through 1995 General Motors (GM) vehicles that are not equipped with an on-board-diagnostics II (OBD II) system, as listed in Appendix A. The GM Whipplecharger kits consist of a supercharger, air cleaner system, ^{adjustable} auxiliary fuel pressure regulator, powertrain auxiliary controller box (PAC) and manifold air pressure sensor, and other plumbing components necessary to install the kit. The GM Whipplecharger kit operates in conjunction with the original equipment manufacturer's (OEM) computer controlled fuel injection system and emission control system already certified with the stock engine.

The purpose of supercharging an engine is to increase its volumetric efficiency at particular engine loads and throttle positions by forcing more air into the engine than it would normally consume in a non-supercharged condition. At light engine loads and small throttle openings, the engine manifold pressure and power output is the same as a normally aspirated engine. At heavy engine loads and increased throttle openings, the manifold pressure is increased by the supercharger allowing more air and fuel to enter the engine, resulting in higher power output.

The supercharger is a positive displacement twin screw rotor compressor powered by a crankshaft driven serpentine belt. The supercharger is driven using the engine's standard serpentine belt loop system. The air needed to operate the supercharger enters the engine compartment through the stock fender location and into the supplied air cleaner. Air then enters the stock throttle body injection, mounted at the rear of the supercharger. The fuel injection is controlled by the OEM electronic control module (ECM). The total engine air flow amount is controlled in the same manner as the OEM, by the throttle plate in the throttle body. The air/fuel mixture is compressed between the supercharger inlet and outlet ports by the design of the twin screw rotors. When the inlet throttle plates are opened to allow for more flow, the mixture exits the outlet port at a higher pressure into the stock manifold. Maximum positive manifold pressure is limited to 8.0 psi at wide-open throttle.

The original ECM calculates the correct fuel delivery necessary during all normal engine operating conditions. Additional fuel required at rapid throttle openings, and during boost conditions, is supplied by temporarily increasing the fuel pressure to the injectors on the throttle body injection through an externally mounted auxiliary fuel pressure regulator. The main fuel delivery is calculated by the stock ECM and is determined from input readings of manifold pressure, engine RPM, throttle position, and coolant temperature. Power enrichment fuel is determined by the ECM and supplemented by the increased fuel pressure determined by the auxiliary fuel pressure regulator.

The OEM ECM is retained. The Whipplecharger kit supplies a powertrain auxiliary controller box (PAC) and an additional manifold absolute pressure sensor. The PAC, installed under the hood, receives input of manifold pressure

at the throttle body and intake manifold. The PAC uses these two inputs to calculate a corrected value for the OEM PCM MAP input. The PCM uses this corrected MAP signal with other engine inputs to calculate the required engine fuel delivery.

When the GM Whipplecharger kit is installed, the heated-air intake system is removed. Instead, engine coolant is routed through the throttle body mounting adapter on the supercharger which increases fuel atomization during cold engine operation. Installation of Whipple Industries, Inc.'s GM Whipplecharger kits do not alter the OEM location of the oxygen sensor and the catalyst. The tune-up specifications also remain the same.

V. DISCUSSION OF THE SUPERCHARGER

A 1995 General Motors C1500 truck equipped with a 4.3L engine certified to Tier-One emission standards was used for the evaluation of the GM Whipplecharger kits. The dynamometer inertia weight and loading were 5000 lbs and 14 hp respectively.

Comparative intake manifold air pressure tests conducted by California Environmental Engineering for Whipple Industries, Inc. consisted of one Hot-Start 505 LA4 drive cycle with the 4.3L in the baseline configuration, followed by one Hot-Start 505 LA4 drive cycle with GM Whipplecharger kit # 3116944-C1 installed. Staff evaluated the graphs produced during the test procedure and found that the intake manifold air pressure did not significantly change. Whipple Industries, Inc. claims that if intake manifold air pressure is unchanged during the drive cycle and since modifications are activated by positive intake manifold air pressure, then the superchargers do not alter

the performance of the OEM system. Therefore, if the GM Whipplecharger kit does not alter the performance of the OEM system, then it cannot adversely affect exhaust emissions. The Air Resources Board (ARB) did not perform confirmatory testing on the intake manifold air pressure tests.

The ARB did not perform any durability testing at this time and reserves the right, in the future, to request further documentation of this device's effect on vehicle emission control system durability. Based on the above discussion, the installation of Whipple Industries, Inc. GM Whipplecharger kits should not have an adverse effect on exhaust emission of the requested vehicle applications.

Whipple Industries, Inc. submitted all the required information and fulfilled the requirements for the exemption.

Appendix A

Whipple Supercharger Kits Part Number List E.O. D-231-7

<u>Part Number</u>	<u>Vehicle Application</u>
(all models except those equipped with OBD II)	
<i>Tier 0 Vehicles</i>	
3116944-S	1988-94 GM 4.3 liter S-10 models
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* HD - Heavy Duty Vehicles

** MD - Medium Duty Vehicles

Appendix B

WHIPPLE SUPERCHARGER KITS PART NUMBER LIST (Rev A) August 26, 1993

Old Part Number	New Part Number	Vehicle Application
WI-TEC S3116-93-4A	3116934-S	1988-93 GM 4.3 liter S-10 model trucks
Not Applicable	3116944-S	1994 GM 4.3 liter S-10 model trucks
WI-TEC C3116-93-4A	3116934-C	1988-93 GM 4.3 liter C/K model trucks
Not Applicable	3116944-C	1994 GM 4.3 liter C/K model trucks
Not Applicable	3116944-HD*	1994 GM 4.3 liter C/K HD model trucks
WI-TEC 3133-89-5A	3133895-C	1989 GM 5.0/5.7 liter C/K model trucks
WI-TEC 3133-91-5A	3133915-C	1990-91 GM 5.0/5.7 liter C/K model trucks
WI-TEC 3133-93-5A	3133935-C	1992-93 GM 5.0/5.7 liter C/K model trucks
Not Applicable	3133945-C	1994 GM 5.0/5.7 liter C/K model trucks
Not Applicable	3133945-HD*	1994 GM 5.0/5.7 liter C/K HD model trucks
WI-TEC 3150-89-7A	3150897-C	1988-89 GM 7.4 liter C/K model trucks
WI-TEC 3150-90-7A	3150907-C	1990 GM 7.4 liter C/K model trucks
WI-TEC 3150-93-7A	3150937-C	1991-1993 GM 7.4 liter C/K model trucks
Not Applicable	3150947-C	1994 GM 7.4 liter C/K model trucks
Not Applicable	3150947-HD*	1994 GM 7.4 liter C/K HD model trucks

* Kits with the suffix HD, are C/K trucks with a Gross Vehicle Weight (GVW) rating of over 8500 pounds.