

State of California  
AIR RESOURCES BOARD

EXECUTIVE ORDER D-112-2  
Relating to Exemptions under Section 27156  
of the Vehicle Code

TURBO INTERNATIONAL  
TURBOCHARGER KIT NO. 4500  
(CHEVY/GMC HEAVY-DUTY 454 CID)

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 add-on turbocharger kit number 4500 (using a 1.0 A/R ratio Rajay 301E turbocharger) manufactured by Turbo International of 7091A Belgrave Avenue, Garden Grove, California 92641, 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 the following General Motors Corporation vehicles powered by a 454 CID engine:

1. 1978 through 1983 model-year heavy-duty vehicles (GVW over 8,500 lbs).
2. 1977 and older model-year heavy-duty vehicle (GVW over 6,000 lbs).
3. 1978 and 1979 model-year medium-duty vehicles (GVW of 6,001 through 8,500 lbs).

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.

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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 TURBO INTERNATIONAL ADD-ON TURBOCHARGER KIT NO. 4500.

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 28<sup>th</sup> day of July, 1983.

  
K. D. Drachand, Chief  
Mobile Source Control Division

STATE OF CALIFORNIA

AIR RESOURCES BOARD

EVALUATION OF TURBO INTERNATIONAL'S TURBOCHARGER KIT NO. 45000  
FOR EXEMPTION FROM THE PROHIBITIONS IN VEHICLE CODE  
SECTION 27156 IN ACCORDANCE WITH SECTION 2222,  
TITLE 13 OF THE CALIFORNIA ADMINISTRATIVE CODE

AUGUST 10, 1983

August 10, 1983

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TITLE 13 OF THE CALIFORNIA ADMINISTRATIVE CODE

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

Turbo International, of 7091A Belgrave Avenue, Garden Grove, California 92641 has applied for exemption from the prohibitions in Vehicle Code Section 27156 of their add-on turbocharger kit number 45000. The kit is intended for installation on the following General Motors Corporation vehicles powered by a 454 CID engine:

1. 1978 through 1983 model-year heavy-duty vehicles (GVW over 8,500 lbs).
2. 1977 and older model-year heavy-duty vehicle (GVW over 6,000 lbs).
3. 1978 and 1979 model-year medium-duty vehicles (GVW of 6,001 through 8,500 lbs).

Emission test results submitted by Turbo International and generated by the ARB test facility indicate that the add-on turbocharger kit number 45000 will not significantly affect emissions from vehicles for which exemption is requested.

Based on the above, the staff recommends that Turbo International be granted an exemption as requested and that Executive Order D-112-2 be granted.

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EVALUATION OF TURBO INTERNATIONAL'S TURBOCHARGER KIT NO. 45000 FOR EXEMPTION FROM THE PROHIBITIONS IN VEHICLE CODE SECTION 27156 IN ACCORDANCE WITH SECTION 2222, TITLE 13 OF THE CALIFORNIA ADMINISTRATIVE CODE

I. INTRODUCTION

Turbo International, of 7091A Belgrave Avenue, Garden Grove, California 92641 has applied for exemption from the prohibitions in Vehicle Code Section 27156 of their add-on turbocharger kit number 45000. The kit is intended for installation on the following General Motors Corporation vehicles powered by a 454 CID engine:

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Turbo International has submitted data from back-to-back emission tests conducted on a 1982 General Motors Corporation heavy-duty Sierra pick-up truck at Custom Engineering Performance and Emissions Laboratory in Garden Grove, California. Confirmatory tests were conducted on the same vehicle at the Air Resources Board (ARB) Laboratory in El Monte, California.

II. CONCLUSION

Emission test results submitted by Turbo International and generated by the ARB test facility indicate that the add-on turbocharger kit number 45000 will not significantly affect emissions from vehicles for which exemption is requested.

### III. RECOMMENDATIONS

Based on the above conclusion, the staff recommends that Turbo International be granted an exemption as requested and that Executive Order D-112-2 be granted.

### IV. TURBOCHARGER KIT DESCRIPTION AND OPERATION

The purpose of turbocharging an engine is to increase its volumetric efficiency by forcing more air into an engine than it would take in under naturally aspirated conditions.

The major components of the Turbo International kit are a Rajay turbocharger model number E10 (now manufactured by Rotomaster) with an A/R ratio of 1.0, a replacement exhaust manifold (right bank), a crossover pipe, an EGR valve, replacement primary and secondary metering rods, a carburetor-to-intake manifold adapter box, and a water injection system. The components are packaged with installation hardware and instructions and sold as a kit.

The crossover pipe routes exhaust from the left cylinder bank (driver's side) to join the right cylinder bank at the Turbo International replacement manifold. The turbine inlet of the turbocharger mounts directly to the exhaust manifold. Intake air/fuel mixture, taken from the carburetor, is compressed by the compressor and returned to the intake manifold through the carburetor-to-intake manifold adapter box.

The original primary and secondary metering rods in the carburetor are replaced by metering rods #52P and #AX, respectively. Turbo International, who supplies the replacement metering rods, claims that the new rods increases fuel delivery for proper and efficient operation of the kit. Turbo International also claims that the additional secondary fuel will suppress detonation during power demand operations.



Water injection is employed to suppress detonation. Water is piped from a small plastic reservoir through a solenoid to the adapter box. The solenoid is activated by a signal from a pressure sensor located on the adaptor box at the compressor outlet. When 1 psig of pressure is sensed, the solenoid injects water into the adapter box, ahead of the turbocharger, through a 0.042 inch orifice.

Maximum positive manifold pressure is limited to 7 psig by the size of the compressor inlet. No wastegate or other active boost limiting device is used.

An EGR valve is mounted on the engine to control NOx exhaust emissions. The EGR valve, part number PF7041427, is furnished by Turbo International to be mounted on the intake manifold (right hand side). The vacuum line from the EGR valve is connected to the vacuum/thermo switch located at front, top of the vehicles water pump. Vacuum signal to the vacuum/thermo switch is obtained from ported vacuum source at the carburetor.

No modifications to the vehicle manufacturer's tune-up specifications are required when the turbocharger kit is installed. All OEM emission controls, including the air injection to BOTH exhaust banks, are left intact.

#### V. TURBOCHARGER KIT EVALUATION

A 1982 General Motors Corporation heavy-duty Sierra pick-up truck powered by a 454 CID engine was used for the evaluation of the turbocharger kit. A description of the vehicle and test parameters is given in the Appendices.

Evaluation consisted of comparative (without and with the kit installed on the test vehicle) cold-start CVS-75 and hot-start Highway Fuel Economy tests for measuring exhaust emissions and fuel economy. Tests were performed under contract by Custom Engineering for Turbo International and confirmed by the ARB Laboratory.

A synopsis of the test data is tabulated in the Appendices.

## V. DISCUSSION

Heavy-duty engines are emissions tested for certification on engine dynamometers. Because exhaust emission tests on engine dynamometer are more time consuming and cumbersome than chassis dynamometer tests, it was decided that chassis dynamometer exhaust emission tests would be more practical for evaluating the effects the add-on turbocharger would have on emissions.

The original design installation instructions of the turbocharger kit recommended that the vehicle's carburetor be retained unmodified and the air injection to the right bank be disconnected. As a result, HC and CO exhaust emissions were adversely affected during the cold transient phase of the CVS-75 emissions test. Driveability problems (stalls and poor acceleration) were also noted during cold engine operations.

In order to improve cold driveability and reduce emissions (to be comparable with baseline emissions), Turbo International installed different primary and secondary metering rods and reinstalled the right bank air injection tubes. According to Turbo International, the replacement metering rods will increase the fuel delivery and improve driveability. They also claim that reinstalling the air injection, at the right bank, will reduce HC exhaust emissions. The emissions results with these modifications are shown in the tables (Appendices) and superscripted with (2).

APPENDICES

Table 1  
Description of Test Vehicle

Model Year:	1982
Manufacturer:	General Motors Corporation
Model:	Sierra pick-up
Engine Size:	454 CID
Emission Control:	Air injection

Table 2

Applicant's Exhaust Emission Test Data  
Evaluation of Turbo International Turbo Kit 45000  
1982 GMC Sierra Pick-up

<u>Test</u>	Exhaust Emissions (g/mi)			Fuel Economy (mpg)	
	<u>HC</u>	<u>CO</u>	<u>NOx</u>	<u>Urban</u>	<u>Hwy</u>
Baseline	1.62	28.9	5.2	9.2	13.6
Device (1)	2.68	49.5	4.5	8.8	10.2
Device (1)	2.43	44.7	5.2	8.9	10.4
Device (2)	1.52	23.6	4.3	7.8	-

(1): Carburetor unmodified, right bank air injection disconnected.

(2): Carburetor modified, right bank air injection connected.

Table 3

ARB's Exhaust Emission Test Data  
 Evaluation of Turbo International Turbo Kit 45000  
 1982 GMC Sierra Pick-up

<u>Test</u>	Exhaust Emissions (g/mi)			Fuel Economy (mpg)	
	<u>HC</u>	<u>CO</u>	<u>NOx</u>	<u>Urban</u>	<u>Hwy</u>
Baseline	1.46	24.3	5.2	10.2	12.7
Baseline	<u>1.23</u>	<u>22.7</u>	<u>5.4</u>	<u>10.1</u>	<u>12.8</u>
Average	1.35	23.5	5.3	10.2	12.8
Device (1)	4.08	58.3	4.0	9.2	12.3
Device (2)	1.02	12.8	2.3	10.6	11.5

- (1): Carburetor unmodified, right bank air injection disconnected.  
 (2): Carburetor modified, right bank air injection connected.