State of California
AIR RESOURCES BOARD

EXECUTIVE ORDER D-430
Relating to Exemptions Under Section 27156
of the Vehicle Code

TURBODYNE SYSTEMS, INC.
BUSPAC ELECTRIC SUPERCHARGER

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 39515 and Section 39516 of the Health and Safety Code and Executive Order G-45-9;

IT IS ORDERED AND RESOLVED: That the installation of the BusPac, manufactured and marketed by Turbodyne Systems, Inc., 6155 Carpinteria Avenue, Carpinteria, CA 93013 has 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 the following Detroit Diesel engine family group applications: 6V92TA, 1980-87, excluding engine families GGM0552FZG7, HGM0552FZG6, HDD0552FZG1; & 6L71TA, 1988-90. The exclusions from the engine family group 6V92TA are due to the introduction of electronically controlled fuel injection.

The BusPac includes the following main components: electric supercharger (TurboPac 2500), check valve, wye connection, flex hose, hose clamps, intake plenum pressure switch, throttle switch, master switch, and supercharger controller.

This Executive Order is valid provided that the installation instructions for the BusPac 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 BusPac, as exempt by the Air Resources Board, which adversely affect the performance of the vehicle's pollution control system shall invalidate this Executive Order.

Marketing of the BusPac using any identification other than that shown in this Executive Order or marketing of the BusPac 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 the BusPac shall not be construed as exemption to sell, offer for sale, or advertise any component of the kit as an individual device.

This Executive Order does not constitute any opinion as to the effect the use of the Buspac 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 TURBODYNE SYSTEMS, INC.'S BUSPAC.

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 a 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 30th day of June, 1997.

R. B. Summerfield
Assistant Division Chief
Mobile Source Division

State of California
AIR RESOURCES BOARD

EVALUATION OF TURBODYNE SYSTEMS, INC.'S BUSPAC FOR EXEMPTION FROM THE PROHIBITIONS OF VEHICLE CODE SECTION 27156 IN ACCORDANCE WITH SECTION 2222, TITLE 13, OF THE CALIFORNIA CODE OF REGULATIONS

June 1997

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AIR RESOURCES BOARD

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by

Mobile Source Division
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

Turbodyne Systems, Inc. of 6155 Carpinteria Ave., Carpinteria, California, 93013 has applied for an exemption from the prohibitions in Section 27156 of the California Vehicle Code (VC) for their BusPac electric supercharger designed for the following Detroit Diesel heavy-duty engine family group applications: 6V92TA, 1980-87, excluding engine families GGM0552FZG7, HGM0552FZG6, HDD0552FZG1; & 6L71TA, 1988-90.

Based on emissions test results, the staff concludes that the BusPac will not adversely affect exhaust emissions from vehicles for which the exemption is requested.

The staff recommends that Turbodyne Systems, Inc. be granted an exemption as requested and that Executive Order D-430 be issued.

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CALIFORNIA CODE OF REGULATIONS

I. INTRODUCTION

Turbodyne Systems, Inc. of 6155 Carpinteria Avenue, Carpinteria, CA 93013 has applied for an exemption from the prohibitions in Section 27156 of the California Vehicle Code (VC) for their BusPac electric supercharger designed for the following Detroit Diesel heavy-duty engine family group applications: 6V92TA, 1980-87, excluding engine families GGM0552FZG7, HGM0552FZG6, HDD0552FZG1; & 6L71TA, 1988-90. The exclusions from the engine family group 6V92TA are due to the introduction of electronically controlled fuel injection.

II. CONCLUSIONS

Based on comparative emissions testing performed with and without the BusPac installed, the staff concludes that Turbodyne Systems, Inc.'s BusPac will not adversely affect exhaust emissions from the vehicles for which the exemption is requested.

III. RECOMMENDATION

The staff recommends that Turbodyne Systems, Inc. be granted an exemption for their BusPac for installation on those applicable Detroit Diesel heavy-duty engine family group applications: 6V92TA, 1980-87, excluding engine families GGM0552FZG7, HGM0552FZG6, HDD0552FZG1; & 6L71TA, 1988-90. The staff also recommends that Executive Order D-430 be issued.

IV. BUSPAC DESCRIPTION

The BusPac is an electric supercharger that can be installed on almost any vehicle. The kit operates in conjunction with the original equipment manufacturer's (OEM) mechanical 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 and power output at particular engine loads and throttle openings. With a conventional turbocharged engine, boost is minimal at low engine speed. The BusPac is designed to supply boost at low engine speed in order to optimize the air fuel ratio as the vehicle begins to move. In diesel vehicles, high particulate and hydrocarbon emissions occur at this time. At heavy engine loads and increased throttle openings, the manifold pressure is increased by the stock turbocharger allowing more air and fuel to enter the

engine, resulting in a higher power output, but there is a lag. With the BusPac, as soon as the engine speed is brought above idle, the BusPac is activated, supplying boost to the engine (3 to 6 psi). When the stock turbocharger begins to reach normal boost levels (8 psi), the increased manifold air pressure is sensed by the BusPac intake plenum pressure switch and the BusPac is deactivated. At this time, the vehicle has accelerated into motion, and the engine and stock turbocharger are beginning to operate at normal speed. The BusPac is driven utilizing an electric motor and can be shut off at anytime by turning off the master control switch.

The BusPac uses a centrifugal type blower, designed to produce a maximum boost of 6 psi (3-6 psi typical). The installation of the kit does not require any major modifications to the stock Detroit Diesel engine, except for the insertion of the check valve and wye connection to the air intake piping. The intake plenum pressure switch is installed between the stock turbocharger and the engine intake manifold. The throttle switch is mounted to the governor. All other BusPac connections are electrical.

V. DISCUSSION OF THE BUSPAC

A 1985 model-year federally-certified Detroit Diesel 6V92TA mechanical fuel injected engine was used for the evaluation of the Buspac. The engine was tested on an engine dynamometer at the Southwest Research Institute. Testing consisted of two EPA Heavy-Duty Transient Emission Test Cycle in the baseline and modified configurations. The ARB did not perform testing to confirm the test results submitted by the applicant.

Results from comparative testing conducted at the Southwest Research Institute between the stock and modified configuration yielded decreases in hydrocarbons (HC), carbon monoxide (CO), & particulate matter (PM), and a small increase in oxides of nitrogen (NOx). The increase in NOx was within the permitted 10% of baseline. The weighted test results in grams per brake-horsepower-hour were as follows:

	HC	CO	NOx	PM
Baseline (cold)	0.582	1.339	9.241	0.175
BusPac (cold)	0.446	1.141	9.697	0.171
Baseline (hot)	0.640	1.676	9.932	0.196
BusPac (hot)	0.525	1.186	10.323	0.162
Baseline (weighted)	0.621	1.579	9.560	0.192
BusPac (weighted)	0.514	1.18	10.156	0.164
% change weighted	-17	-25	+6	-15
% of baseline limit	+10	+15	+10	+15

Although Turbodyne conducted testing on a federally-certified engine, the results from installing the BusPac are expected to be similar for California certified engines since the technology of the engines for California and federal are similar: throttle delay, after cooler, mechanical fuel injection, direct injection, and turbocharger. Since none of the controls are electronic and could not adapt to the presence of the BusPac, test results performed with California-certified engines are expected to yield very similar results. Therefore, based on the test results, the staff concludes that the installation of the BusPac will not have an adverse effect on exhaust emissions on California-certified engines.

Turbodyne Systems, Inc. has submitted all the required information and fulfilled the requirements for an exemption.