

State of California  
AIR RESOURCES BOARD

EXECUTIVE ORDER D-97-16  
Relating to Exemptions under Section 27156  
of the Vehicle Code

BAE TURBOSYSTEMS  
TURBOCHARGER KIT NO. 3-0012

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 BAE add-on turbocharger kit No. 3-0012 (using a turbocharger with an A/R ratio of 1.0) manufactured by BAE Turbosystems of 3032 Kashiwa Street, Torrance, CA 90505, 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 1982 and 1983 model-year BMW 633i and 733i models, and 1983 model-year BMW 533i models having a 195.9 cubic inch displacement (CID) six-cylinder engine.

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 BAE TURBOCHARGER KIT NO. 3-0012.

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.

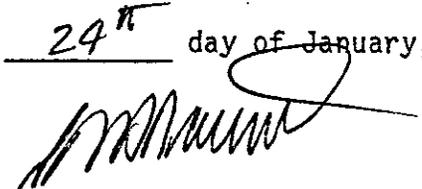
Section 43644 of the Health and Safety Code provides as follows:

"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.

Executive Order No. D-97-12, dated February 25, 1982, is superseded and of no further force and effect.

Executed at El Monte, California, this 29<sup>th</sup> day of January, 1983.



K. D. Drachand, Chief  
Mobile Source Control Division

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STATE OF CALIFORNIA  
AIR RESOURCES BOARD

EVALUATION OF THE BAE TURBOCHARGER KIT  
NO. 3-0012 FOR EXEMPTION FROM THE  
PROHIBITIONS IN VEHICLE CODE SECTION 27156  
IN ACCORDANCE WITH SECTION 2222, TITLE  
13 OF THE CALIFORNIA ADMINISTRATIVE CODE

January 4, 1983

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IN ACCORDANCE WITH SECTION 2222, TITLE  
13 OF THE CALIFORNIA ADMINISTRATIVE CODE

by

State of California  
Air Resources Board  
9528 Telstar Avenue  
El Monte, California  
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

BAE Turbosystems of 3032 Kashiwa Street, Torrance, CA 90505, has requested by letter dated December 14, 1982, an update to the existing Air Resources Board's Executive Order (E.O.) No. D-97-12. The applicant requested that their add-on turbocharger kit No. 3-0012 be also exempted from the prohibitions in Vehicle Code (V.C.) Section 27156 for the 1983 model-year BMW 533i, 633i, and 733i model vehicles powered by a 195.9 cubic inch displacement (CID) six-cylinder gasoline engine.

Based on the previous comparative exhaust emissions tests performed on 1981 and 1982 model-year BMW 633i models and the fact that the engines used in the 1983 model-year BMW 533i, 633i, and 733i model vehicles are carry-overs (identical engine design) from the 1981 and 1982 models, the staff concludes that the kit will not adversely affect exhaust emissions from the 1983 BMW 533i, 633i, and 733i models.

The staff recommends that BAE Turbosystems be granted their update request to include the 1983 model-year BMW 533i, 633i, and 733i model vehicles in the exemption of their add-on turbocharger kit No. 3-0012. The staff recommends that Executive Order No. D-97-16 be adopted.

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EVALUATION OF THE BAE TURBOCHARGER KIT NO. 3-0012 FOR EXEMPTION FROM THE PROHIBITIONS IN VEHICLE CODE SECTION 27156 IN ACCORDANCE WITH SECTION 2222, TITLE 13 OF THE CALIFORNIA ADMINISTRATIVE CODE.

I. INTRODUCTION

BAE Turbosystems of 3032 Kashiwa Street, Torrance, CA 90505, has requested by letter dated December 14, 1982, an update to the existing Air Resources Board's Executive Order (E.O.) No. D-97-12. The applicant requested that their add-on turbocharger kit No. 3-0012 be also exempted from the prohibitions in Vehicle Code (V.C.) Section 27156 for the 1983 model-year BMW 533i, 633i, and 733i model vehicles powered by a 195.9 cubic inch displacement (CID) six-cylinder gasoline engine.

II. CONCLUSION

Based on the previous comparative exhaust emissions tests performed on 1981 and 1982 model-year BMW 633i models and the fact that the engines used in the 1983 model-year BMW 533i, 633i, and 733i model vehicles are carry-overs (identical engine design) from the 1981 and 1982 models, the staff concludes that the kit will not adversely affect exhaust emissions from the 1983 BMW 533i, 633i, and 733i models.

III. RECOMMENDATION

The staff recommends that BAE Turbosystems be granted their update request to include the 1983 model-year BMW 533i, 633i, and 733i model vehicles in the exemption of their add-on turbocharger kit No. 3-0012. The staff recommends that Executive Order No. D-97-16 be adopted.

#### IV. TURBOCHARGER KIT DESCRIPTION AND OPERATION

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

The major components of the BAE turbocharger kit No. 3-0012 are a turbocharger (with an A/R ratio of 1.0), a replacement BAE exhaust manifold, a pressure control wastegate, a fuel enrichment control, and a boost pressure controlled fuel regulator. The components are packaged with installation hardware and installation instructions and sold as a kit.

The original equipment manufacturer (OEM) exhaust manifold is replaced by a BAE manifold. The turbine inlet mounts directly to the replacement manifold. The turbine, driven by exhaust gases, is linked to the compressor by a solid shaft. Intake air from the air box, of the L-Jectronic fuel injection system, is routed to the compressor. Compressed air is then piped to the intake plenum through the discharge pipe.

The lubrication of the turbocharger is provided by a steel-braided line from the oil filter adapter located at the engine block to the turbocharger bearing housing. Oil from the turbocharger is returned to the engine block.

Maximum positive manifold pressure (boost) is limited to 7 psig by a wastegate mounted on the exhaust manifold. The wastegate is preset to dump excess exhaust gases when intake manifold pressure reaches 7 psig.

The kit also contains a fuel enrichment control. The control has a vacuum line which tees to the left side of the intake plenum for sensing positive boost conditions. Also attached to the control are three sets of wire which link to the oxygen sensor, temperature sensor, and throttle valve switch. When 2 psig is sensed by the control, the throttle valve opens allowing more intake air and fuel into the combustion chamber. Upon sensing 3.5 psig of boost pressure, the oxygen and temperature sensors are deactivated to signal the computer (in the car) to run in the rich mode as in cold-start/warm-up conditions.

Additional fuel enrichment is provided by the BAE boost pressure controlled fuel regulator during high boost pressures. The regulator is positioned in the fuel return line between the OEM fuel pressure regulator and the fuel tank. During high boost conditions, the BAE regulator blocks the return line and increases the pressure differential across the injectors, thus forcing more fuel to be injected.

A vacuum delay valve is used to control NOx emissions and to suppress detonation. The valve is installed in the vacuum line prior to the vacuum retard mechanism of the distributor.

No modifications to the OEM tune-up specifications are required when the turbocharger kit is installed. All OEM emission controls are left intact.

BAE recommends that premium non-leaded fuel be used with the turbocharger kit, but regular non-leaded fuel is compatible.

V. DISCUSSION

BAE turbocharger kit No. 3-0000W1 applicable to 1980 and 1981 model-year BMW 633i and 733i model vehicles powered by a 195.9 CID six-cylinder gasoline engine was granted an exemption (E.O. No. D-97-7) on October 7, 1981. The exemption was granted on the basis that the effectiveness of the vehicle's pollution control system was not reduced. Evaluation consisted of comparative (without and with the kit installed on a test vehicle) chassis dynamometer CVS-75 and HFET tests at normal and multiple dynamometer road loading.

Turbocharger kit No. 3-0000W1 was modified to accommodate the engines in the 1982 models. The modified kit, kit No. 3-0012, has identical components, except for the discharge pipe (pipe for routing intake air from the turbocharger compressor outlet into the intake plenum). Although the discharger pipes are bent differently, the kits are identical in operation and performance.

The 1982 model-year BMW 633i and 733i model vehicles have a higher nominal compression ratio (8.8:1 compared to 8.0:1). In order for the applicant to demonstrate that the kit will not adversely affect the exhaust emissions from the 1982 BMW models, the applicant performed comparative exhaust emissions tests on a 1982 model. Since the comparative tests indicated that the exhaust emissions from the 1982 model was not adversely affected by the installation of the add-on turbocharger kit, an exemption was granted for kit No. 3-0012.

The applicant is making available kit No. 3-0012 for the 1983 models. The applicant has requested that the exemption be updated to include the 1983 models.

In response to the request, the staff compared the engine design of both 1982 and 1983 model-years. Since the engines in the 1983 models are identically designed as the 1982 engines, the staff is of the opinion that the 1983 vehicles will have the same degree of performance/emissions impact as in the 1982 models. Because the test data on a 1982 test vehicle showed that the vehicle's emissions were not adversely affected when the turbocharger kit was installed, the kit will have no adverse effect on the 1983 models either. No additional testing was required or performed.