

State of California
AIR RESOURCES BOARD

EXECUTIVE ORDER D-97-7
Relating to Exemptions under Section 27156
of the Vehicle Code

BAE
TURBOCHARGER KIT NO. 3-0000W1

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 turbocharger kit number 3-0000W1 manufactured by BAE, of 3032 Kashiwa Street, Torrance, California 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 1980 and 1981 model-years BMW 633i and 733i models having a 195.9 cubic inch displacement 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. 3-0000W1.

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 7 day of October, 1981.


K. D. Drachand, Chief
Mobile Source Control Division

State of California
AIR RESOURCES BOARD

Staff Report

October 7, 1981

Evaluation of the BAE Turbocharger Kit
No. 3-0000W1 for Compliance with the
Requirements of Section 27156 of the Vehicle Code

I. INTRODUCTION

BAE, of 3032 Kashiwa Street, Torrance, California 90505, has applied for exemption of a turbocharger kit from the prohibitions of Section 27156 of the Vehicle Code (V.C.). The kit, turbocharger kit number 3-0000W1, is intended for 1980 and 1981 model-year BMW 633i and 733i models having a 195.9 cubic inch displacement (CID) six-cylinder gasoline engine.

BAE has submitted comparative emissions data from back-to-back cold-start CVS-75 and hot-start HFET tests on a 1981 BMW 633i model with 5-speed manual transmission conducted at Olson Engineering, Inc., in Huntington Beach, California.

Confirmatory tests were conducted on the same vehicle at the Air Resources Board (ARB) laboratory in El Monte, California.

II. TURBOCHARGER KIT DESCRIPTION

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 number 3-0000W1 are a turbocharger (Rajay Model No. 300E or Airesearch Model No. TA04 H3), 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 return 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.

III. TEST PROGRAM

A 1981 BMW 633i model with a six-cylinder engine and 5-speed manual transmission was used for testing. The certification test weight is 3875 lbs. The road load horsepower (RLHP) used in the testing was 12.6 horsepower at 50 mph.

Testing at the ARB laboratory consisted of cold-start CVS-75 and hot-start HFET tests at normal RLHP to determine exhaust emissions of the unmodified (baseline) and turbocharged (device) configurations for comparison.

IV. TEST DATA

The applicant's and ARB's emissions test data are shown in Table 1 and Table 2, respectively:

Table 1

Applicant's Emissions Test Data

		Exhaust Emissions (g/mi)			Fuel Economy (mpg)
<u>Test</u>		<u>HC</u>	<u>CO</u>	<u>NOx</u>	
Baseline	CVS-75	0.37	2.23	0.53	15.2
Device	CVS-75	0.28	2.21	0.35	14.0
Baseline	HFET	0.14	1.30	0.23	21.3
Device	HFET	0.07	0.44	0.47	22.0

Table 2

ARB's Emissions Test Data

		Exhaust Emissions (g/mi)			Fuel Economy (mpg)
<u>Test</u>		<u>HC</u>	<u>CO</u>	<u>NOx</u>	
Baseline	CVS-75	0.40	2.42	0.72	14.8
Device	CVS-75	0.35	2.69	0.39	14.4
Baseline	HFET	0.18	1.04	0.48	23.0
Device	HFET	0.11	0.60	0.48	23.4

V. DISCUSSION

The two sets of CVS-75 and HFET comparative emissions tests show that the turbocharger kit, when installed, will not adversely affect the vehicle's exhaust emissions.

VI. CONCLUSION AND RECOMMENDATIONS

Comparative emissions tests indicate that the BAE turbocharger kit number 3-0000W1 will not adversely affect exhaust emissions when installed in accordance with the manufacturer's instructions. The staff recommends that BAE be granted an exemption from the prohibitions of V.C. Section 27156 for this kit for 1980 and 1981 model-years BMW 633i and 733i models having a 195.9 CID six-cylinder engine. The staff recommends that Executive Order No. D-97-7 be adopted.