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State of California
AIR RESOURCES BOARD

EXECUTIVE ORDER D-97-4
Relating to Exemptions under Section 27156
of the Vehicle Code

BAE
TURBOCHARGER KIT MODEL NO. 2-0000-1

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 model number 2-0000-1 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 1981 model year BMW 320i models having a 107 cubic inch displacement four-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 MODEL NO. 2-0000-1.

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.

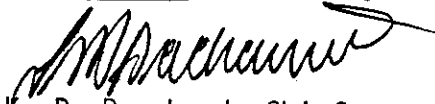
Section 17500 of the Business and Professions Code makes untrue or misleading advertising unlawful, and Section 17534 makes violation punishable as a misdemeanor.

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 8th day of July, 1981.


K. D. Drachand, Chief
Mobile Source Control Division

State of California
AIR RESOURCES BOARD

Staff Report

July 1, 1981

Evaluation of the BAE Turbocharger Kit Model No. 2-0000-1 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 California Vehicle Code (V.C.). The kit, turbocharger kit model number 2-0000-1, is intended for 1981 model year BMW 320i models having a 107 CID four-cylinder engine.

BAE has submitted comparative emissions data from back-to-back cold-start CVS-75, hot-start HFET, and steady state exhaust emissions tests on a 1981 BMW 320i 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. The ARB testing consisted of cold-start CVS-75 and hot-start HFET exhaust emissions tests at normal road load horsepower.

II. TURBOCHARGER KIT DESCRIPTION

The purpose of turbocharging is to increase the volumetric efficiency of an engine. The major components of the BAE turbocharger kit are a RaJay turbocharger model 300F, a replacement exhaust manifold, a replacement intake plenum, an intake and a discharge pipe, and a positive manifold pressure control wastegate. The components are packaged with installation hardware and instructions and sold as a kit (see Figure 1).

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

The lubrication of the turbocharger is provided by a steel braided line from the filtered engine oil galley to the turbocharger bearing housing. Oil from the turbocharger is returned to the oil pan.

Maximum positive manifold pressure (boost) is limited to 5 psig by a wastegate mounted on the exhaust manifold. The wastegate is preset to dump excess exhaust gases when intake manifold pressure reaches 5 psig, thus bypassing the turbine.

No modifications to the OEM tune-up specifications are required when the turbocharger kit is installed except for disconnecting the ignition distributor vacuum advance unit and plugging it at the throttle body with a plug supplied by BAE. All other OEM emission controls remain intact.

III. TEST PROGRAM

A 1981 BMW 320i model with a four-cylinder engine and 5-speed manual transmission was used for testing. The certification test weight is 2750 lbs. The road load horsepower (RLHP) used in the testing was 11.5 horsepower at 50 mph.

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

IV. APPLICANT'S TEST DATA

The applicant's emissions test data in Tables 1 & 2 were generated at Olson Engineering, Inc.

Table 1

Applicant's Emissions Test Data

<u>Test</u>	<u>Load</u>	Exhaust Emissions (g/mi)			Fuel Economy (mpg)
		<u>HC</u>	<u>CO</u>	<u>NOx</u>	
Baseline CVS-75	1XRL	0.38	3.14	0.30	21.4
Device CVS-75	1XRL	0.37	2.76	0.48	22.6
Baseline HFET	1XRL	0.06	0.68	0.30	28.3
Device HFET	1XRL	0.06	0.73	0.30	31.9

Table 2

Applicant's Emissions Test Data

<u>Mode</u>	<u>Load</u>	Exhaust Emissions (ppm)		
		<u>HC</u>	<u>CO</u>	<u>NOx</u>
Baseline Idle	1XRL	60	350	-
Device Idle	1XRL	41	100	-
Baseline 40 mph/4*	1XRL	60	2350	125
Device 40 mph/4	1XRL	34	2100	66
Baseline 40 mph/5**	1XRL	60	1955	100
Device 40 mph/5	1XRL	42	1860	96
Baseline 50 mph/4*	1XRL	60	2200	160
Device 50 mph/4	1XRL	34	1400	150
Baseline 50 mph/5**	1XRL	60	1600	135
Device 50 mph/5	1XRL	44	1320	120
Baseline 55 mph/5**	1XRL	60	1400	190
Device 55 mph/5	1XRL	45	1050	175

*in 4th gear

**in 5th gear

V. ARB's TEST DATA

The ARB's confirmatory emissions test data is shown in Table 3.

Table 3

ARB Emissions Test Data

<u>Test</u>	<u>Load</u>	<u>Exhaust Emissions (g/mi)</u>			<u>Fuel Economy (mpg)</u>
		<u>HC</u>	<u>CO</u>	<u>NOx</u>	
Baseline CVS-75	1XRL	0.41	3.14	0.39	21.3
Device CVS-75*	1XRL	0.78	5.74	0.33	22.9
Device CVS-75**	1XRL	0.93	7.42	0.27	23.3
Device CVS-75	1XRL	0.47	3.37	0.19	22.9
Baseline HFET	1XRL	0.15	1.12	0.53	27.6
Device HFET	1XRL	0.11	1.66	0.28	30.7

*Data invalid - oxygen sensor wire disconnected.

**Data invalid - cracked BAE replacement exhaust manifold.

VI. DISCUSSION

Results of the steady state tests indicate that there are no increases in pollutants with the turbocharged vehicle over the baseline during all modes of testing.

The two (2) sets of valid CVS-75 and HFET comparative emissions tests (Tables 1 and 3) show that the emissions of the test vehicle are slightly changed due to the installation of the turbocharger kit. The differences, however, are considered to be within test variability and insignificant.

VII. CONCLUSION AND RECOMMENDATION

Comparative emissions tests indicate that the BAE turbocharger kit model number 2-0000-1 will not significantly affect 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 1981 model year BMW 320i models having a 107 CID four-cylinder engine. The staff recommends that Executive Order No. D-97-4 be adopted.

FIG. 1: BAE TURBOCHARGER KIT MODEL NO. 2-0000-1

