

State of California
AIR RESOURCES BOARD

EXECUTIVE ORDER D-140-1
Relating to Exemptions under Section 27156
of the Vehicle Code

SPEARCO PERFORMANCE PRODUCTS, INC.
"TURBOCHARGER KIT
(INCLUDING AN OPTIONAL INTERCOOLER)
FOR 2.8 LITER TOYOTA SUPRA AND CRESSIDA VEHICLES"

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 (using a 0.98 A/R ratio Ishikawajima-Harima Heavy Industries turbocharger), with an optional intercooler, manufactured by Spearco Performance Products, Inc., of 7541 Woodman Place, Van Nuys, California 91405, 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 Toyota vehicles with a 2.8 liter (168 CID) fuel injected six-cylinder engine:

<u>Turbo Kit No.</u>	<u>Vehicle Models</u>
9898	• 1982 Supra
9899	1983 Supra
9900	1983 Cressida
9909 (intercooled)	1982-1984 Supra
9910 (intercooled)	1983-1984 Cressida

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 SPEARCO ADD-ON TURBOCHARGER KIT FOR 2.8 LITER TOYOTA SUPRA AND CRESSIDA VEHICLES.

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 6TH day of February, 1984.



K. D. Drachand, Chief
Mobile Source Division

STATE OF CALIFORNIA

AIR RESOURCES BOARD

EVALUATION OF SPEARCO PERFORMANCE PRODUCTS, INC.'S ADD-ON TURBOCHARGER KIT
WITH AN OPTIONAL INTERCOOLER FOR 2.8 LITER TOYOTA SUPRA AND CRESSIDA VEHICLES
FOR EXEMPTION FROM THE PROHIBITIONS IN VEHICLE CODE SECTION 27156 IN ACCORDANCE
WITH SECTION 2222, TITLE 13, OF THE CALIFORNIA ADMINISTRATIVE CODE.

FEBRUARY 1, 1983

Date of Issue: February 1, 1983

EVALUATION OF SPEARCO PERFORMANCE PRODUCTS, INC.'S ADD-ON TURBOCHARGER KIT WITH AN OPTIONAL INTERCOOLER FOR 2.8 LITER TOYOTA SUPRA AND CRESSIDA VEHICLES FOR EXEMPTION FROM THE PROHIBITIONS IN VEHICLE CODE SECTION 27156 IN ACCORDANCE WITH SECTION 2222, TITLE 13, OF THE CALIFORNIA ADMINISTRATIVE CODE.

by

Mobile Source 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

Spearco Performance Products, Inc. has requested an exemption from the prohibitions in Vehicle Code Section 27156 for a series of their add-on turbocharger kits, with an optional intercooler, for installation on 1982 through 1984 Toyota Supra and Cressida vehicles with a 2.8 liter (168 CID) six-cylinder fuel injected engine.

Based on the results from comparative exhaust emission tests performed by Spearco at an independent laboratory on a 1984 Toyota Supra, and from confirmatory tests performed by the ARB on the same vehicle, the staff concludes that Spearco's turbocharger kit (with and without the optional intercooler) evaluated will not adversely affect exhaust emission from vehicles for which exemption is requested.

The staff recommends that Spearco Performance Products, Inc. be granted an exemption as requested and that Executive Order D-140-1 be issued.

CONTENTS

	<u>Page Number</u>
<u>SUMMARY</u>	i
<u>CONTENTS</u>	ii
I. <u>INTRODUCTION</u>	1
II. <u>CONCLUSION</u>	1
III. <u>RECOMMENDATIONS</u>	1
IV. <u>TURBOCHARGER KIT DESCRIPTION AND OPERATION</u>	2
V. <u>TURBOCHARGER KIT EVALUATION</u>	3
VI. <u>DISCUSSION</u>	3
 <u>APPENDICES</u>	 5
 <u>APPLICATION LIST</u>	 6
<u>TEST RESULTS</u>	7

EVALUATION OF SPEARCO PERFORMANCE PRODUCTS, INC.'S ADD-ON TURBOCHARGER KIT WITH AN OPTIONAL INTERCOOLER FOR 2.8 LITER TOYOTA SUPRA AND CRESSIDA VEHICLES FOR EXEMPTION FROM THE PROHIBITIONS IN VEHICLE CODE SECTION 27156 IN ACCORDANCE WITH SECTION 2222, TITLE 13, OF THE CALIFORNIA ADMINISTRATIVE CODE.

I. INTRODUCTION

Spearco Performance Products, Inc., of 7541 Woodman Place, Van Nuys, California 91405, has requested an exemption from the prohibitions in Vehicle Code Section 27156 for a series of their add-on turbocharger kits. The turbocharger kits, which have an optional intercooler, are intended for installation on 1982 through 1984 Toyota Supra and Cressida vehicles with a 2.8 liter (168 CID) fuel injected six-cylinder engine. The list of kits and their applications is shown in the Appendices.

Spearco has submitted data from comparative (stock baseline versus turbocharged with and without the intercooler installed) emission tests conducted on a 1984 Toyota Supra at FCI International Testing Lab., in Santa Ana, California. Confirmatory tests were conducted on the same vehicle at the Air Resources Board (ARB) Laboratory in El Monte, California.

II. CONCLUSION

Based on the results from comparative exhaust emission tests performed by Spearco at an independent laboratory on a 1984 Toyota Supra and from confirmatory tests performed by the ARB on the same vehicle, the staff concludes that Spearco's turbocharger kits (with and without the optional intercooler) evaluated will not adversely affect exhaust emission from vehicles for which exemption is requested.

III. RECOMMENDATIONS

The staff recommends that Spearco be granted an exemption for their add-on turbocharger kits as requested and that Executive Order D-140-1 be issued.

IV. TURBOCHARGER KIT DESCRIPTION AND OPERATION

The original equipment manufacturer (OEM) exhaust manifold is replaced by a Spearco 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 is routed from the air flow meter to the compressor by the compressor inlet pipe. It is then compressed and routed into the intake plenum through the cross-over pipe. Exhaust gases from the turbine is routed to the catalytic converter via the exhaust downpipe.

Lubrication and cooling of the turbocharger is provided by a steel braided line from a tap into the main oil galley. Oil from the turbocharger is returned to the oil pan.

Maximum positive pressure (boost) is limited to 5 psi by a wastegate internally mounted in the housing of the turbocharger. The wastegate is preset so that boost pressure cannot exceed 5 psi. In addition to the internal wastegate, a separate intake blow-off valve is included to relieve pressure at 7 psi in the event that the wastegate malfunctioned.

The kit also includes a fuel enrichment device. The device connects to the intake manifold and coolant temperature sensor. When boost pressure reaches 4 psi, the device increases the electrical resistance of the temperature sensor. This increase in electrical resistance dictates the vehicle's computer to increase the fuel flow through the injector nozzles, thus enriching the fuel charge during boost conditions above 4 psi.

An electronic spark retard module is employed to suppress detonation during boost conditions or heavy load operations. The module utilizes a sensor, mounted on the intake manifold or cylinder head, to detect detonation. When detonation is detected, the module electronically retards the spark until detonation is eliminated.

An optional air/liquid intercooler system is also available from Spearco for installation on these vehicles. An intercooler core casting replaces the compressor discharge cross-over casting pipe in the standard turbocharger kit. Liquid is circulated through this core by a separate pump actuated by boost pressure. When the pump is triggered, the circulation goes through the intercooler core and through a coil mounted in front of the vehicle which is exposed to ambient air flow. This ambient air flow cools the fluid which is then circulated to the intercooler core, thereby cooling the compressed air before it enters the engine.

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

V. TURBOCHARGER KIT EVALUATION

A 1984 Toyota Supra vehicle with a 2.8 liter fuel-injected six-cylinder engine was used for testing. The dynamometer inertia weight and loading used was 3375 lbs. and 10.1 hp, respectively.

Testing conducted by FCI International Testing Lab, under contract for Spearco, consisted of a series of cold-start CVS-75 tests to determine exhaust emissions in the unmodified (baseline) and turbocharged (without and with the intercooler) configurations for comparison. The ARB conducted confirmatory tests at the El Monte laboratory. A summary of the test results is tabulated in the Appendices.

VI. DISCUSSION

The applicant requested an exemption of an add-on turbocharger kit applicable to 1982 Supra, and 1982 through 1984 Supra and Cressida Toyota vehicles with a 168 CID engine. The applicant is also offering an optional intercooler system compatible with the turbocharger kit. In order to

demonstrate compliance with the requirements for the exemption, comparative emissions tests were performed in order to compare unmodified (baseline) exhaust emissions to the turbocharged configurations, without and with the intercooler system functioning.

Both sets (Spearco's and ARB's) of comparative (baseline versus turbocharged/not intercooled and baseline versus turbocharger/intercooled) exhaust emission test data show that when the turbocharger kit (with or without the intercooler) was installed, CO and NOx emissions were significantly reduced, while HC were not adversely affected. This reduction in CO and NOx emissions can be attributed to the additional ambient air injected into the engine by the compressor, thus leaning the fuel charge and lowering combustion temperature. The data also shows that the intercooler system had no effect on exhaust emissions under the CVS test conditions.

APPENDICES

TURBOCHARGED KITS APPLICATION

<u>Turbo Kit No.</u>	<u>Vehicle Models</u>
9898	1982 Supra
9899	1983 Supra
9900	1983 Cressida
9909 (intercooled)	1982-1984 Supra
9910 (intercooled)	1983-1984 Cressida

Table 1

Spearco's Exhaust Emission Test Data
 Evaluation of Spearco Turbocharger Kit
 1984 Toyota Supra
 Cold-Start CVS-75

<u>Test Mode</u>	<u>Exhaust Emission (g/mi)</u>			<u>Fuel Economy (mpg)</u>	
	<u>THC</u>	<u>CO</u>	<u>NOx</u>	<u>City</u>	<u>Highway</u>
Stock/Baseline	0.27	3.5	0.6	18.3	23.3
Stock/Baseline	<u>0.31</u>	<u>3.5</u>	<u>0.5</u>	<u>18.0</u>	<u>--</u>
Avg.	0.29	3.5	0.6	18.2	23.3
Turbocharged (not intercooled)	0.31	1.8	0.2	16.9	21.6
Turbocharger (not intercooled)	<u>0.27</u>	<u>1.4</u>	<u>0.2</u>	<u>17.8</u>	<u>--</u>
Avg.	0.29	1.6	0.2	17.4	21.6
Turbocharged (intercooled)	0.26	1.4	0.2	16.8	--

Table 2

ARB's Exhaust Emission Test Data
 Evaluation of Spearco Turbocharger Kits
 1984 Toyota Supra
 Cold-Start CVS-75

<u>Test Mode</u>	<u>Exhaust Emission (g/mi)</u>			<u>Fuel Economy (mpg)</u>	
	<u>THC</u>	<u>CO</u>	<u>NOx</u>	<u>City</u>	<u>Highway</u>
Stock/Baseline	0.37	7.2	0.5	18.0	27.1
Stock/Baseline	<u>0.40</u>	<u>7.2</u>	<u>0.6</u>	<u>17.9</u>	<u>27.3</u>
Avg.	0.39	7.2	0.6	18.0	27.2
Turbocharged (intercooled)	0.27	2.5	0.3	18.1	26.9
Turbocharged (intercooled)	<u>0.35</u>	<u>3.5</u>	<u>0.2</u>	<u>18.0</u>	<u>25.5</u>
Avg.	0.31	3.0	0.2	18.1	26.2
Turbocharged (not intercooled)	0.28	3.3	0.2	17.7	26.6