

State of California
AIR RESOURCES BOARD

EXECUTIVE ORDER D-180
Relating to Exemptions under Section 27156
of the Vehicle Code

THE TURBO SHOP
TURBOCHARGER KIT MODEL 6.9L/7.3L

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 model 6.9L/7.3L manufactured by The Turbo Shop using an Allied Signal Turbocharger model No. T04B with an A/R ratio of 1.0 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 installation of 1983 through 1987 model-year Ford Motor Company vehicles powered by a 6.9L Navistar International heavy-duty diesel engine and 1988 model-year Ford Motor Company vehicles powered by a 7.3L Navistar International heavy-duty diesel engine.

Modifications to the OEM emission-related parts due to the installation of the turbocharger include replacement of air cleaner assembly and replacement of the OEM exhaust system with a 3" diameter exhaust system.

This Executive Order is valid provided that installation instructions for this device will not recommend tuning the vehicle to specifications different from those listed by the vehicle 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 TURBO SHOP TURBOCHARGER KIT MODEL 6.9L/7.3L.

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 16th day of June, 1988.


K. D. Drachand, Chief
Mobile Source Division

State of California
AIR RESOURCES BOARD

EVALUATION OF THE TURBO SHOP ADD-ON TURBOCHARGER KIT
MODEL 6.9L/7.3L FOR INSTALLATION IN 1983-1987 MODEL-YEAR
FORD MOTOR COMPANY VEHICLES POWERED BY A 6.9 LITER
NAVISTAR INTERNATIONAL HEAVY-DUTY DIESEL ENGINE AND
1988 MODEL-YEAR FORD MOTOR COMPANY VEHICLES POWERED BY
A 7.3 LITER NAVISTAR INTERNATIONAL HEAVY-DUTY DIESEL ENGINE

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by

Mobile Source Division

State of California
AIR RESOURCES BOARD
9528 Telstar Avenue
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(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

The Turbo Shop has applied for exemption from the prohibitions in Vehicle Code Section 27156 for their add-on turbocharger kit Model 6.9L/7.3L designed for 1983-1987 Ford Motor Company vehicles which are powered by the Navistar International 6.9 liter heavy-duty diesel engine and 1988 model-year Ford Motor Company vehicles powered by a 7.3 liter Navistar International heavy-duty diesel engine.

The Turbo Shop has submitted a completed application and all the required information as well as comparative exhaust emissions data which shows that their kit does not have a significant adverse effect on the emissions from the vehicles described above. Testing performed at the Haagen-Smit Laboratory confirmed the results of the tests performed by the Turbo Shop.

The staff recommends that the Turbo Shop be granted an exemption for their add-on turbocharger kit and that Executive Order D-180 be issued.

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A 7.3 LITER NAVISTAR INTERNATIONAL HEAVY-DUTY DIESEL ENGINE

I. INTRODUCTION

The Turbo Shop of 940 West Manchester, Inglewood, California 90301, has applied for exemption from the prohibitions of Vehicle Code Section 27156 for their add-on turbocharger kit Model No. 6.9L/7.3L for 1983-1987 Ford Motor Company vehicles powered by the 6.9 liter Navistar International heavy-duty diesel engine and 1988 model-year Ford Motor Company vehicles powered by a 7.3L Navistar International heavy-duty engine.

The Turbo Shop has submitted a completed application, all the necessary information and comparative exhaust emissions data. Also, confirmatory testing was performed at the Haagen-Smit Laboratory.

II. CONCLUSION

Based on the submitted information and the comparative exhaust emissions tests performed on a 1987 Ford F-250 heavy-duty diesel truck at the ARB and Olson Engineering Inc., the staff concludes that the installation of the Turbo Shop turbocharger kit Model 6.9L/7.3L will not have a significant adverse effect on the exhaust emissions from the vehicles for which the exemption has been requested.

III. RECOMMENDATIONS

The staff recommends that the Turbo Shop be granted an exemption for its turbocharger kit for use on 1983-1987 Ford Motor Company heavy-duty vehicles powered by the 6.9 liter Navistar International heavy-duty diesel engine and 1988 model-year Ford Motor Company vehicles powered by a 7.3L Navistar International heavy-duty engine, and that Executive Order D-180 be issued.

IV. TURBOCHARGER KIT DESCRIPTION

The purpose of the Turbo Shop turbocharger system is to increase the power output of the engine by increasing the volumetric efficiency of it by compressing the intake charge to pressures above that of the atmosphere. This increased pressure allows a greater charge density to enter the combustion chamber providing more oxygen for combustion. The maximum fuel delivery is slightly increased (1/4 of a turn) in order to maintain proper air-fuel ratios with the increased air flow from the turbocharger when it is providing positive manifold pressure (boost).

The major components of the system include a 1.0 A/R ratio Allied Signal Model No. T04B turbocharger, custom intake adaptors, 3" diameter exhaust tubing, air cleaner assembly, brackets, hoses and the hardware necessary to complete the installation. The OEM exhaust system is replaced by a 3" diameter exhaust system.

Maximum positive manifold pressure is limited to 10 psig by the size of the turbine and the compressor. The maximum engine speed is regulated by the OEM fuel injection governor. Therefore, by controlling maximum engine speed, maximum turbine speed and corresponding boost pressures are also controlled.

Modification to the OEM emission-related parts due to the installation of the turbocharger kit include replacement of the air cleaner assembly and replacement of the OEM exhaust system with a 3" diameter exhaust system. The positive crankcase ventilation (PCV) valve is relocated to allow the turbocharger installation. No other OEM emission controls are removed or disconnected when the turbocharger kit is installed.

Installation instructions, included in every kit, show the kit installer how to properly install the turbocharger system and adjust the maximum fuel delivery properly (see Appendix A). A prototype identification label is shown in Appendix B.

V. TURBOCHARGER KIT EVALUATION

Evaluation of the Turbo Shop turbocharger kit included analysis of all submitted information to confirm that it meets the requirements for the exemption, a comparison of the submitted exhaust emissions data, and a comparison of the confirmatory emissions data generated at the Haagen-Smit Laboratory.

The test vehicle was a 1987 Ford F-250 pick-up truck with an automatic transmission. The Turbo Shop had requested in writing that the 1988 Ford heavy-duty diesel vehicles be included in the exemption. Based on the fact that the 1988 7.3L Navistar International heavy-duty diesel engine is a replacement engine for the 1987 6.9L engine and both engines have similar designs and the 7.3L engine design complies with the carryover criteria as outlined in EPA's Advisory Circulars 17F and 20B, the 1988 7.3L engine is included in the exemption.

The Turbo Shop performed comparative exhaust emissions tests at Olson Engineering, Inc., in Huntington Beach, California, on a 1987 Ford F-250. The test program used was the "Test Program for Add-on Turbocharger Kits for Heavy-Duty Engines" (see Appendix C). The results of these tests are shown in Table 1.

Table 1

Comparative Emissions Testing of
The Turbo Shop Turbocharger at Olson Engineering

| <u>Mode</u> | <u>Configuration</u> | <u>Results in ppm</u> | | |
|-------------|----------------------|-----------------------|-----------|------------|
| | | <u>HC</u> | <u>CO</u> | <u>NOx</u> |
| Idle | Baseline | 254 | 702 | 2428 |
| | Device | 295 | 675 | 1110 |
| | Change % | +16 | -4 | -54 |
| 20 MPH | Baseline | 281 | 530 | 3478 |
| | Device | 236 | 350 | 2312 |
| | Change % | -16 | -33 | -34 |
| 30 MPH | Baseline | 217 | 392 | 2823 |
| | Device | 239 | 408 | 2050 |
| | Change % | +10 | +4 | -27 |
| 40 MPH | Baseline | 292 | 558 | 2715 |
| | Device | 320 | 522 | 2521 |
| | Change | +9 | -6 | -7 |
| 50 MPH | Baseline | 491 | 852 | 2464 |
| | Device | 579 | 834 | 2217 |
| | Change % | +18 | -2 | -10 |

Confirmatory testing was performed at the Haagen-Smit Laboratory and the results are shown in Table 2.

Table 2

Comparative Emissions Testing of
The Turbo Shop Turbocharger Kit on a 1987 Ford Vehicle
With 6.9L Heavy-Duty Diesel Engine

| <u>Mode</u> | <u>Configuration</u> | <u>Results</u> | | |
|-------------|----------------------|----------------|------------|-----------------|
| | | <u>HC(ppm)</u> | <u>CO%</u> | <u>NOx(ppm)</u> |
| Idle | Baseline | 24.10 | 0.02 | 435.50 |
| | Device | 16.80 | 0.01 | 332.50 |
| | Change % | -30 | -50 | -26 |
| 20 MPH | Baseline | 21.20 | 0.01 | 795.50 |
| | Device | 18.90 | 0.01 | 617.50 |
| | Change % | -11 | 0.0 | -22 |
| 30 MPH | Baseline | 21.50 | 0.01 | 762.50 |
| | Device | 25.50 | 0.02 | 743.00 |
| | Change % | +19 | +100 | -3 |
| 40 MPH | Baseline | 35.15 | 0.02 | 1116.0 |
| | Device | 33.90 | 0.03 | 863.0 |
| | Change % | -4 | +50 | -23 |
| 50 MPH | Baseline | 62.55 | 0.04 | 1222.50 |
| | Device | 44.90 | 0.03 | 896.00 |
| | Change % | -28 | -25 | -27 |
| 55 MPH | Baseline | 74.75 | 0.04 | 1192.50 |
| | Device | 61.60 | 0.05 | 878.00 |
| | Change % | -18 | +25 | -26 |

VI. DISCUSSION

The steady-state test results at Olson Engineering, Inc., and the ARB indicate that emissions at some test points are increased. The Olson Engineering test results show increases in HC emissions and the results of the confirmatory testing show increases in HC and CO emissions with the turbocharger installed. Although these increases seem to be significant in percentage, they are not significant in magnitude. Based on that, the staff believes that the installation of the Turbo Shop 6.9L/7.3L turbocharger kit will not have significant adverse effects on the exhaust emissions from the vehicles for which exemption is requested.

APPENDIX A (CONTINUED)

* INSTALLATION PROCEDURE *

1. Locate the exhaust pyrometer gauge and gauge mounting bracket. Install bracket and gauge in suitable place in drivers compartment per manufactures instructions. Drill and tap the driverside exhaust manifold between the 3rd and 4th exhaust ports for the gauge probe. After the gauge has been connected start the engine and allow to idle for several minutes. This will blow any chips from the drilling and taping of the manifold out of the manifold, stop engine and disconnect the negative battery cables at both batteries. (This is for safety only)

2. Remove air cleaner assembly.

3. Remove right rear engine lifting bracket and bolts, save bolts.

4. Remove positive crankcase ventilator valve from rear of intake manifold, save as it will be used later.

NOTE: On 1987 and later vehicles it will be necessary to move the glowplug control relay on the back of the engine. Locate the "T" shaped bracket and mount it between the third and fourth injector on the passengerside of the engine on the intake manifold. Mount the relay to the bracket on the center mounting holes. The outer holes are to tie the wireloom too. You will have to cut one wire and extend it to move the wireloom.

5. Remove oil sender from rear of the engine.

6. If vehicle is equipped with acoustic shield on the firewall it must be removed from the area between the left and right heads.

7. Locate the lip where the firewall is attached to the floorpan in the transmission tunnel. Bend this lip toward the rear of vehicle and upward as far as possible. See fig. #1 for location of the area to be bent. It may be necessary to slightly reshape the heatshield on the passengerside floorboard for proper exhaust pipe clearance. Use the exhaust pipes to check for clearance.

8. Install oil sender adapter fittings where oil sender was removed from, first the 1/4" street elbow then the 1/4" street tee facing the center outlet up. Next install the oil line fitting in the rear outlet with the line connection facing upward. Next install the oil sender into the center outlet of the tee. When the assembly is complete it should face rearward and slightly toward the passengerside of the vehicle.

9. Install turbo oil pressure line to the oil line fitting installed in the previous step, using the straight end of the hose. Position the hose so that the free end faces toward the front of the vehicle, tighten the line.
10. Clean hole in rear of intake manifold where positive crankcase ventilator was removed. Install rubber plug supplied with kit into the hole and tighten. **DO NOT OVER TIGHTEN!**
11. Relocate the vacuum block on the firewall above the passengerside valve cover 2" to the left and 2" upward from the original location.
12. Reroute the vacuum hose that goes to the powerbrake unit thru the retaining hangers located on the top of the firewall.
13. Vehicles equipped with automatic transmission must rebend the steel vacuum line at the rear of the engine to run along the top edge of the passengerside valvecover next to the intake manifold.
14. Locate the 3" exhaust pipe and round 4 bolt flange. Slide the flange onto the pipe with the beveled edge first. Install the pipe and flange into the vehicle behind the passengerside head toward bottom of vehicle. It maybe necessary to rotate the pipe on the way between the engine and firewall. Check for proper clearance around the pipe, pay attention to the area of the firewall that was bent back. There must be a minimum of 1/4" between the pipe and firewall.
15. Locate the 1/2 " long spacers, 3/8-16 x 3 1/4" bolts and the turbo mounting pipe. Install 3/8-16 bolts into holes on the bracket on pipe. Install pipe into vehicle from behind intake manifold downward toward driverside of vehicle. Using the 1/2" long spacers mount the pipe to intake manifold where lifting bracket was removed. **DO NOT TIGHTEN BOLTS.**
16. Raise vehicle and remove stock exhaust system. Cut the head pipes and remove the exhaust flanges.
17. Locate the new head pipes, 2 1/4" muffler clamp, 2 1/2" muffler clamp and a flange removed from the stock head pipes. Install the flange onto the new head pipe and slide pipe into the slip joint on the other pipe. Install assembly into the vehicle using the two muffler clamps and the stock nuts from the exhaust manifolds. The head pipes must fit into the slipjoint on the turbo mount pipe before bolting to the exhaust manifolds. Check for clearance around all pipes and tighten all connections as well the two bolts holding turbo mount pipe to the intake manifold. There must be a minimum clearance of 3/8" between turbo mount pipe and the firewall where it was bent!

18. Vehicles with automatic transmission must remove the dipstick tube and replace it with a new tube. (sold separately) Install per instructions sold with tube. You may rebend the stock tube so that it clears the exhaust pipe and comes up behind the passengerside head.

19. Locate turbocharger, oil drain pipe, oil drain bushing, oil drain gasket and four (4) 3/8-16 x 1" header bolts. Loosen the twelve (12) bolts in the center of turbocharger. Remove the plug from oil drain in turbocharger. Install oil drain pipe to turbocharger with gasket and two (2) header bolts. Slide oil drain bushing on end of drain pipe. Install assembly onto the turbo mount pipe with two (2) header bolts making sure oil drain pipe fits into tube in the valley of the engine where positive crankcase ventilator was removed. Tighten two (2) of the bolts holding the center of the turbocharger to the exhaust housing. Set the discharge hat onto the intake manifold and align the compressor housing outlet with the hat inlet, tighten two (2) of the bolts holding the compressor housing to the turbocharger. Remove the turbocharger assembly from pipe and tighten the remaining bolts per manufactures instructions. See fig. #2

20. Reroute the injector return hose, throttle cable, cruise control cable and wiring loom at the rear of the intake manifold. It will be necessary to cut the tape holding the oil sender wire into the loom. Pull wire out of the loom and route along passengerside valvecover to rear of engine and onto sender. Using the ties provided tie the cables and wire loom to the mounting lugs where the positive crankcase ventilator was mounted. Now tie the injector return hose to the wire loom, be careful not to pull the ties to tight and pinch line off! See fig. #3

21. Locate heatshield, eight (8) header bolts, turbocharger flange gasket, turbocharger assembly, 2" dia. silicone hose, #32 hose clamps, bolts from engine lift bracket, 1/4 to -4 hose fitting, discharge hat and safety wire. Install the -4 hose fitting into the turbocharger facing the -4 connection to the rear when installed on the vehicle. Clean intake manifold where air cleaner used to mount and run a bead of silicone around manifold. Install discharge hat using bolt and washer from lifting bracket and silicone to seal bolt and washer in place. Install 2" silicone hose and hose clamps to the inlet of hat. Coat the end of the oil drain pipe with silicone and slide oil drain bushing on. Coat the end of the oil drain bushing with silicone and install turbo assembly into the vehicle with four (4) header bolts and gasket. Connect the turbo discharge to the discharge hat with hose and clamps. Tighten the clamps and hat hold down bolt. Take safety wire and connect one end to the button on the rear of heatshield. Place heatshield in position on turbo and secure with safety wire. Attach oil supply line to turbo fitting. With four (4) remaining header bolts attach 3" exhaust pipe, check for proper clearance and tighten.

APPENDIX A (CONTINUED)

22. Locate air cleaner housing, turbo connecting tube, 3" silicone hose, #48 hose clamps, positive crankcase ventilator and bolts and 5/16 -18 x 3/4 bolts with washers. Using 5/16 bolts and washers mount the air cleaner housing to the discharge hat. Put silicone sealer on the threads and under the washers before installing. Install the turbo connecting tube using the 3" silicone hose and #48 hose clamps. Mount the positive crankcase ventilator to the turbo connecting tube using original bolts, washers and seal.
23. Locate the oil fill adapter, oil vent tube, 1" rubber hose & clamps. Remove o-ring and plastic washer from the positive crankcase ventilator and install the 1" rubber hose. Mount the oil fill adapter to the front of the injector pump cover. On early model engines this will be between the oil fill tube and cover on late model engines there is just a flat plate to remove on the cover. Install the oil vent tube into the adapter with silicone sealer and the other end into the rubber hose on the ventilator. Tighten clamps on hose.
24. Install air cleaner into air cleaner cover and attach to air cleaner housing.
25. Do a final inspection of your installation making sure all connections are tight and properly position. All hoses and lines are away from hot exhaust and turbocharger. Use extra heat blanket to shield anything that cannot be moved or is close to hot parts.
26. Reconnect negative battery cables and start vehicle. **DO NOT REV ENGINE, ALLOW TO IDLE FOR A FEW MINUTES.** During this time check all connections for leaks and proper operation of gauges installed. Stop engine and repair as necessary.

EXHAUST SYSTEM

We have designed an exhaust system to give you maximum performance with the turbo system. The next best possible exhaust system would be a 3" exhaust with a quality low restriction muffler.

CAUTION

Excessive backpressure will result in high exhaust temperature. Under no conditions should the exhaust temp. rise above 1150 deg. F. serious engine damage may occur!

INJECTOR PUMP ADJUSTMENT

To obtain maximum performance from your turbo system it is necessary to make an injector pump adjustment. This adjustment increases the total amount of fuel delivery to the engine. This with the increased supply of air provided by the turbocharger will give you power gains of as much as 60%.

Cleanliness is the most important thing to remember when the pump is being adjusted. Do not allow any foreign material to enter the injector pump during this adjustment.

First place a drippan under the vehicle under the flywheel inspection cover area to catch the fuel released during adjustments. Locate the cover on the passengerside of the injector pump, it is secured by two screws. Using a 1/4" wrench loosen the lower screw and remove the upper. This will allow you to rotate the cover and gasket out of the way for access to the adjusting screw. Rotate the engine in a clockwise direction by **HAND ONLY** until the allen head screw appears inside the pump. Center the screw in the opening before trying to adjust it, using a light and mirror will make see the screw much easier.

Using a 5/32" allen wrench adjust the screw inward (clockwise when looking at the screw) will increase fuel flow and increase exhaust temp. , outward (counterclockwise) to decrease fuel flow and lower exhaust temp. . Under no circumstance should the screw be rotated inward more than 1/3 of a turn from it's original setting. **WE RECOMMEND AN INCREASE OF 1/4 TURN INWARD. THIS IS THE ONLY SETTING LEGAL IN THE STATE OF CALIFORNIA.** Increases of more than 1/4 of a turn up to 1/3 turn are for **HIGH PERFORMANCE USE ONLY.**

Exhaust temperature must not exceed 1150 degree fahrenheit as shown on the pyrometer furnished with this kit. If this temperature approaches under heavy uphill load reduce speed and use a lower gear. If vehicle continually reaches this temperature a reduction in the injector pump setting is necessary!

THINGS TO REMEMBER

1. Keep air cleaner element clean. When the element becomes dirty remove from holder and clean per manufactures instructions. A dirty air cleaner will cause excessive oil consumption and high exhaust temperatures.
2. Change oil and filter every 2500 miles.
3. Before shutting engine off make sure exhaust temperature

is below 300 degrees fahrenheit.

4. When starting your engine do not rev the engine! Allow the engine to idle and warm up before driving.

Following these easy directions will give you many trouble free miles of enjoyment from your turbo system.

APPENDIX B

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*****  
*   THE TURBO SHOP  6.9/7.3 L.  *  
*   MODEL # T04B      *  
*   "CARB E.O. No. D-  *  
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Test Program for Add-On Turbocharger Kits for Heavy-Duty Engines

Testing will consist of back-to-back chassis dynamometer tests. Baseline (unmodified configuration) emission results will be compared to turbocharged (modified configuration) emission results on the same vehicle.

A. STEADY STATE TESTS

- 1) Idle
- 2) 20, 30, 40, 50 and 55 mph at 1XRL.

Prior to measuring exhaust emission at any steady state test point, the vehicle's engine temperature shall be stabilized. This is satisfied when engine oil temperature is stabilized as monitored and indicated by a temperature recorder.

If a steady state point is unattainable in the baseline configuration, then the last point at a specified horsepower should be WOT and the speed should be recorded. The test in the turbocharged configuration will be performed at the same speeds and horsepower as the baseline configuration.

Any steady state may be deleted if 1) the steady state exceeds or can be expected to exceed the engine redline or 2) steady state conditions might cause serious damage to vehicle components or dynamometer, or create a hazard for test personnel.

B. STEADY STATE DATA REQUIREMENTS

- 1) CO concentration
- 2) CO₂ concentration
- 3) HC concentration
- 4) NO_x concentration
- 5) engine rpm
- 6) engine oil temperature

C. MISCELLANEOUS

- 1) The same fuel will be used for both the unmodified and modified configurations unless the turbocharger manufacturer's written instructions specify a different fuel for the turbocharged configuration.

APPENDIX C (CONTINUED)

- 2) Tire pressure in the drive wheels will be the maximum indicated on the tire sidewall.
- 3) Test vehicles from secondary manufacturers may be tested without a body shell if 1) the cab is intact, 2) the vehicle is legally driveable on the street, 3) the frontal area is identical to the built-up vehicle, 4) the chassis is loaded to a weight simulating loaded vehicle weight. Loaded vehicle weight is defined as the manufacturer's estimated weight of the vehicle in operational status with all standard equipment, the weight fuel at nominal tank capacity, and the weight of optional equipment.