

State of California
AIR RESOURCES BOARD

EXECUTIVE ORDER D-225-3
Relating to Exemptions Under Section 27156
of the Vehicle Code

CRANE CAM, INC.
FIREBALL CYLINDER HEAD

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 Fireball cylinder head manufactured by Crane Cams, Inc. of 530 Pentress Blvd., Daytona Beach, FL 32114 has been found not to reduce the effectiveness of the applicable vehicle pollution control system and, therefore, is exempt from the prohibitions of Section 27156 of the Vehicle Code for 1992 and older General Motors vehicles sold in California equipped with 262 CID (4.2L) to 400 CID (6.6L) V-8 gasoline engines.

This Executive Order is valid provided that installation instructions for this Fireball cylinder head will not recommend tuning the vehicle to specifications different from those submitted by Crane Cams, Inc.

Changes made to the design or operating conditions of the Fireball cylinder head, as exempt by the Air Resources Board, which adversely affect the performance of a vehicle's pollution control system shall invalidate this Executive Order.

Marketing of this cylinder head using any identification other than that shown in this Executive Order or marketing of this cylinder head 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 the cylinder head shall not be construed as exemption to sell, offer for sale, or advertise any component of the kit as an individual device.

This Executive Order does not constitute any opinion as to the effect the use of this cylinder head 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 CLAIMS OF THE APPLICANT CONCERNING ANTI-POLLUTION BENEFITS OR ANY ALLEGED BENEFITS OF CRANE CAMS' FIREBALL CYLINDER HEAD.

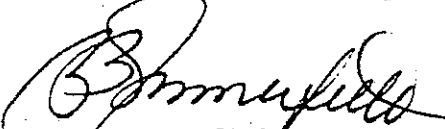
CRANE CAMS, INC.
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No claim of any kind, such as "Approved by the Air Resources Board" may be made with respect to the action taken herein in any advertising or other oral or written communication.

Violation of any of the above conditions shall be grounds for revocation of this order. The order may be revoked only after ten day written notice of intention to revoke the order, in which period the holder of the order may request in writing a hearing to contest the proposed revocation. If a hearing is requested, it shall be held within ten days of receipt of the request and the order may not be revoked until a determination after hearing that grounds for revocation exist.

Executed at El Monte, California, this 8th day of January, 1992.


R. B. Summerfield
Assistant Division Chief
Mobile Source Division

State of California
AIR RESOURCES BOARD

EVALUATION OF CRANE CAMS, INC. FIREBALL CYLINDER HEAD
FOR EXEMPTION FROM THE PROHIBITIONS OF VEHICLE CODE
SECTION 27156 IN ACCORDANCE WITH SECTION 2222, TITLE 13, OF
THE CALIFORNIA CODE OF REGULATIONS

January 1992

State of California
AIR RESOURCES BOARD

EVALUATION OF CRANE CAMS, INC. FIREBALL CYLINDER HEAD
FOR EXEMPTION FROM THE PROHIBITIONS OF VEHICLE CODE
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THE CALIFORNIA CODE OF REGULATIONS

by

Mobile Source Division
State of California
Air Resources Board
9528 Telstar Avenue
El Monte, CA 91731-2990

(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 the mention of trade names or commercial products constitute endorsement or recommendation for use.)

SUMMARY

Crane Cams, Inc. has applied for an exemption from the prohibitions of Vehicle Code Section 27156 for their Fireball cylinder head for installation on 1992 and older General Motors (GM) vehicles equipped with 262 CID (4.2L) to 400 CID (6.6L) V-8 gasoline engines. Crane Cams has submitted a completed application and all the required information, as well as exhaust emission test data performed at Crane Emissions Laboratory which demonstrated that the specified Fireball cylinder head does not have any adverse effects on the exhaust emission of the affected vehicles.

Based on the submitted information, results of the emission tests performed at Crane Emissions Laboratory, and an engineering evaluation, the staff concludes that the installation of Crane Cams' Fireball cylinder head will not adversely affect exhaust emission on the specified vehicles.

The staff recommends Crane Cams, Inc. be granted an exemption as requested and that Executive Order D-225-3 be issued.

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EVALUATION OF CRANE CAMS, INC. FIREBALL CYLINDER HEAD
EXEMPTION FROM THE PROHIBITIONS OF VEHICLE CODE SECTION 27156 IN ACCORDANCE
WITH SECTION 2222, TITLE 13, OF THE CALIFORNIA CODE OF REGULATIONS

I. INTRODUCTION

Crane Cams, Inc. of 530 Fentress Blvd., Daytona Beach, Florida 32114, has applied for an exemption from the prohibitions of Vehicle Code Section 27156 on their Fireball cylinder head for installation on 1992 and older General Motors vehicles. Crane Cams has submitted a completed application and all the required information, as well as exhaust emission test data performed at Crane Emissions Laboratory which show that the Fireball cylinder head does not have any adverse effects on the exhaust emission for those affected vehicles.

II. CONCLUSION

Based on the submitted information, results of the emission tests performed at Crane Emissions Laboratory, and an engineering evaluation, the staff concludes that the Crane Cams' Fireball cylinder head will not adversely affect exhaust emission on those vehicles for which the exemption is requested.

III. RECOMMENDATION

The staff recommends that Crane Cams, Inc. be granted an exemption as requested and that Executive Order D-225-3 be issued.

IV. FIREBALL CYLINDER HEAD DESCRIPTION

The Fireball cylinder head is specifically designed for installation on 1992 and older General Motors vehicles powered by 262 CID (4.2L) to 400 CID (6.6L) V-8 gasoline engines. The Fireball cylinder head operates in conjunction with the original equipment manufacturer's (OEM) emission

control systems already certified with the stock engine. The purpose of using the modified Fireball cylinder head is to increase the overall engine performance and reliability which is accomplished according to the manufacturer, through labor intensive machining and the use of the finest materials available. The intake and exhaust ports are machined to match the gasket and manifold surfaces, thus eliminating reversion at those junctures. The interior surfaces of the ports have been machined in the critical areas to reduce backpressure and maintain laminar flow. The valve seats are machined to provided optimum sealing and increase flow. The combustion chambers are polished to eliminate hot spots which could cause detonation or pre-ignition.

The following are the Fireball cylinder head specifications:

1. Head Casting ----- Cast Iron
2. Valves ----- 2.02" Diameter Intake (Stainless Steel)
----- 1.6" Diameter Exhaust (Stainless Steel)
3. Chamber Volume ----- 67 cc
4. Spark Plug ----- Angled
5. Valve Seals ----- Nitrile
6. Valve Locks ----- Chrome-Moly
& Retainers
7. Valve Springs ----- Dual Chrome-Silicon

V. DISCUSSION OF THE FIREBALL CYLINDER HEAD

Crane Cams submitted emission testing conducted at Crane Emissions Laboratory. A 1984 federally-certified Chevrolet Camaro powered by a 305 CID engine was used as the test vehicle for the Fireball cylinder head. To calibrate the Camaro to California specifications, Crane Cams changed the prom based on documentation given to Crane Cams by General Motors. This

calibration change was verified and accepted by the ARB when Crane Cams was testing for their Compucam 2000 series camshafts on the same GM applications. The dynamometer inertia weight and loading used during the testing were 3625 lbs. and 7.8 hp, respectively.

The emission tests consisted of two cold-start CVS-75 Federal Test Procedure in the modified configuration. The test results are shown in Table 1.

Table 1

CVS-75 TEST RESULTS

(Crane Emissions Laboratory)

Test	Exhaust emission (gm/mi)		
<u>Mode</u>	<u>HC</u>	<u>CO</u>	<u>NOx</u>
Fireball Head Test 1	0.33	5.48	0.66
Fireball Head Test 2	0.26	4.77	0.66
Average of Test 1 & 2	0.295	5.13	0.66
Standard	0.39	7.0	0.7

The CVS-75 emission test results at Crane Emissions Laboratory indicate that HC, CO and NOx emission of the Fireball cylinder head to be below the emission standard set for that engine family.

The ARB did not conduct confirmatory tests to validate the emission test results submitted by Crane Cams. However, an engineering analysis was performed to determine the Fireball cylinder head's effect on the engine's valve characteristics, lift and duration. The Fireball cylinder head is functionally identical to the original equipment manufacturer (OEM)

except for its intake and exhaust valve sizes. A typical GM cylinder head may have intake valves ranging from 1.72 to 1.94 inches and 1.5 to 1.6 inches on exhaust. Crane Cams consolidated these variation by designing their cylinder head to be at the top end of the OEM scale, 2.02 inches on intake and 1.6 inches on exhaust. The exhaust valve diameter is still within acceptable OEM range while the intake valve diameter translates to a 5 percent increase over OEM. This change is insignificant when compared to Crane Cams previously exempted camshafts which increase valve lift and duration up to 20 percent. Staff's analysis supports Crane Cams' test results which show the Fireball cylinder head to have no adverse effect on exhaust emissions of the affected vehicles.

Crane Cams has submitted all the required information and fulfilled the requirements for an exemption. The test results and engineering evaluation confirmed that Crane Cams Fireball cylinder head meet the requirements for the exemption.

APPENDIX

SPECIAL INSTALLATION INSTRUCTIONS

Crane Cams FireBall II™ Cylinder Heads Chevrolet V-8, 1957-91, 267-400 Cubic Inches

Crane Cams FireBall Cylinder Heads utilize the latest in DART precision cast iron cylinder heads from World Products, Inc. We then prepare these heads to provide a moderately priced yet powerful bolt-on racing and performance head assembly.

Each head is individually inspected, then ported and polished to provide maximum airflow with minimum port restrictions. All valve train components used are of the finest quality, engineered, manufactured and tested to the stringent quality control standards that have made Crane Cams the world's largest racing and performance camshaft and valve train company.

These heads should be installed using quality bolts or studs, threads cleaned and lightly oiled. Be sure to "chase" (clean) the threads in your block with the correct size tap to eliminate any dirt or other matter that might affect the final assembly torquing of your heads. Follow your shop manual or the instructions supplied with the bolts or studs for specific torque ratings and installation procedures.

When installing, be sure to use a quality head gasket (such as Fel-Pro) and make sure that your engine block deck surface is clean and true. If you have any problems contact the Crane Cams technical assistance line Monday through Friday, 8:00 am to 8:00 pm, at: 904/258-6174.

Installation Procedures

1. Disconnect the negative battery cable.
2. Place a suitable container beneath the vehicle and drain the coolant thoroughly. Retain the coolant if you intend to reuse it later.
3. Remove the carburetor (or fuel injection) linkage and remove the intake manifold. You may want to label and separately bag the fasteners as they are removed from the engine, for easier re-assembly.
4. Loosen and remove all drive belts. Some engines may require removal of the fan shroud and cooling fan.
5. Before removing the LEFT cylinder head:
 - a. Remove oil dipstick.
 - b. Remove air and vacuum pumps with mounting bracket, if present. Move these items out of the way with hoses attached.
6. Before removing the RIGHT cylinder head:
 - a. Remove alternator.
 - b. Disconnect power steering gear pump and brackets attaching them to the cylinder head.
7. Disconnect spark plug wires and remove spark plug wire clips from the rocker arm cover studs.
8. Remove the exhaust manifold bolts from the head being removed.
9. Using compressed air, blow off all loose dirt and foreign matter or use a cloth to wipe it away.
10. Remove rocker arm cover. Remove rocker arm adjusting nuts, pivot balls and rockers. Remove pushrods.
11. Loosen and remove all cylinder head bolts from head being removed. Repeat Step 10 for opposite head.
12. Thoroughly clean away old head gasket and any remaining gasket residue from engine block deck. You may want to place a few clean shop towels or rags in the cylinder bores to catch any dirt or gasket residue.
13. Carefully clean head bolt (or stud) threads using a wire brush. Use the correct size tap to "chase" the bolt hole threads in the engine block. Lightly oil threads before re-installation.
14. To install Crane FireBall II heads use a quality liquid bolt sealer to prevent coolant leaks or seepage.
15. Install Crane FireBall II heads and torque to 80 ft. lbs. in sequence shown. After both Crane FireBall II cylinder heads have been installed, install accessory items in reverse order of removal (Steps 11 through 1). Torque intake manifold bolts to 45 ft. lbs. (cast iron), aluminum intake manifold bolts should be torques to 30 ft. lbs. Torque exhaust manifold bolts to 25 ft. lbs. Torque intake manifold bolts in sequence shown.

SPECIAL INSTALLATION INSTRUCTIONS

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Chevrolet V-8, 1957-91, 267-400 Cubic Inches

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These heads should be installed using quality bolts or studs, threads cleaned and lightly oiled. Be sure to "chase" (clean) the threads in your block with the correct size tap to eliminate any dirt or other matter that might affect the final assembly torquing of your heads. Follow your shop manual or the instructions supplied with the bolts or studs for specific torque ratings and installation procedures.

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2. Place a suitable container beneath the vehicle and drain the coolant thoroughly. Retain the coolant if you intend to reuse it later.
3. Remove the carburetor (or fuel injection) linkage and remove the intake manifold. You may want to label and separately bag the fasteners as they are removed from the engine, for easier re-assembly.
4. Loosen and remove all drive belts. Some engines may require removal of the fan shroud and cooling fan.
5. Before removing the LEFT cylinder head:
 - a. Remove oil dipstick.
 - b. Remove air and vacuum pumps with mounting bracket, if present. Move these items out of the way with hoses attached.
6. Before removing the RIGHT cylinder head:
 - a. Remove alternator.
 - b. Disconnect power steering gear pump and brackets attaching them to the cylinder head.
7. Disconnect spark plug wires and remove spark plug wire clips from the rocker arm cover studs.
8. Remove the exhaust manifold bolts from the head being removed.
9. Using compressed air, blow off all loose dirt and foreign matter or use a cloth to wipe it away.
10. Remove rocker arm cover. Remove rocker arm adjusting nuts, pivot balls and rockers. Remove pushrods.
11. Loosen and remove all cylinder head bolts from head being removed. Repeat Step 10 for opposite head.
12. Thoroughly clean away old head gasket and any remaining gasket residue from engine block deck. You may want to place a few clean shop towels or rags in the cylinder bores to catch any dirt or gasket residue.
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15. Install Crane FireBall II heads and torque to 80 ft. lbs. in sequence shown. After both Crane FireBall II cylinder heads have been installed, install accessory items in reverse order of removal (Steps 11 through 1). Torque intake manifold bolts to 45 ft. lbs. (cast iron), aluminum intake manifold bolts should be torques to 30 ft. lbs. Torque exhaust manifold bolts to 25 ft. lbs. Torque intake manifold bolts in sequence shown.