State of California
AIR RESOURCES BOARD

EXECUTIVE ORDER D-535-1

Relating to Exemptions under
Section 27156 of the Vehicle Code

Cleaire Advanced Emission Controls
Flash and Catch System

Pursuant to the authority vested in the Air Resources Board (ARB) 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-45-9;

IT IS ORDERED AND RESOLVED: That installation of the *Flash and Catch* diesel retrofit system, manufactured by Cleaire Advanced Emission Controls of 14775 Wicks Boulevard, San Leandro, California 94577, has been found not to reduce the effectiveness of the applicable vehicle pollution control system, and therefore, the *Flash and Catch* system is exempt from the prohibitions in section 27156 of the Vehicle Code for installation on heavy-duty vehicles equipped with 1993 through 1998 model-year Cummins M11 diesel engines.

The *Flash and Catch* system consists of a low NOx rebuild calibration, replacement fuel injectors, and a particulate filter. The system components exempted under this Executive Order are identified in Attachments A, B, and C.

This exemption applies to the engines and low NOx software calibrations Cummins has identified in its "Low NOx Rebuild Calibration Listing." In addition, the exemption is only valid provided that the following conditions are met: (1) the replacement fuel injectors are Cummins ReCon PX injectors remanufactured to meet Cummins' original equipment manufacturer specifications and (2) the filter is Engelhard Corporation's DPX Catalyzed Soot Filter or Johnson Matthey's CRT Particulate Filter exempted by the ARB and is used only on engines that meet the operating conditions (i.e. particulate matter emission level, NOx to PM ratio, engine exhaust temperature, and diesel fuel sulfur level) specified by Engelhard Corporation and Johnson Matthey.

This exemption is based on the emission data submitted by Cleaire Advanced Emission Controls and an engineering evaluation of the impact the systems have on emissions. Based on the test results and evaluation of the system components, it was concluded that the *Flash and Catch* system will not adversely affect the exhaust emissions of the heavy-duty vehicles equipped with any of the engines listed above.

This Executive Order is valid provided that installation instructions for *Flash and Catch* system do not recommend tuning the vehicle to specifications different from those of the vehicle manufacturer.

Attachment A: Cummins Low NOx Rebuild Calibration Listing

Changes made to the design or operating conditions of the *Flash and Catch* system, as exempt by the ARB, which adversely affect the performance of the vehicle's pollution control system, shall invalidate this Executive Order.

Marketing of the *Flash and Catch* system using identification other than that shown in this Executive Order or for an application other than that listed in this Executive Order shall be prohibited unless prior approval is obtained from the ARB.

This Executive Order shall not apply to any *Flash and Catch* system advertised, offered for sale, sold with, or installed on a motor vehicle prior to or concurrent with transfer to an ultimate purchaser.

This Executive Order does not constitute any opinion as to the effect the use of the *Flash and Catch* system may have on any warranty either expressed or implied by the vehicle manufacturer.

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.

In addition to the foregoing, the ARB reserves the right in the future to review this Executive Order and the exemption provided herein to assure that the exempted add-on or modified part continues to meet the standards and procedures of California Code of Regulations, Title 13, Section 2222, et seq.

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 CLEAIRE ADVANCED EMISSION CONTROL'S *FLASH AND CATCH* SYSTEM.

Violation of any of the above conditions shall be grounds for revocation of this Executive Order. The Executive Order may be revoked only after a ten-day written notice of intention to revoke the Executive Order, in which period the holder of the Executive 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 Executive Order may not be revoked until a determination is made after a hearing that grounds for revocation exist.

Executed at El Monte, California, this 2nd day of January 2002.

Raphael Susnowitz

for R. B. Summerfield, Chief
Mobile Source Operations Division

CLEAIRE ADVANCED EMISSION CONTROLS
FLASH AND CATCH SYSTEM – D-535-1

LOW NOx REBUILD CALIBRATION LISTING

Available From: March 1, 2000

CPL: 1855 Engine Model: M11

ENGINE POWER INFORMATION			ECM ELECTRONIC DATA PLATE INFORMATION		
HP	Torque (lb-ft)	Governed Speed	Original Software Calibration (SC) Options and Supercessions	Low NOx SC option	Notes
330	1250	2000	(2798), 2818, 2834, 2889, 2950, 2124, 2285,2474, 2542	20234	
330	1250	1800	2787, 2797, 2817, 2833, 2888, 2935, 2949, 2125, 2286, 2475, 2543	20235	
310	1150	2000	2785, (2796), 2816, 2832, 2887, 2923, 2954, 2129, 2287, 2476, 2544	20236	
310	1150	1800	2786, (2795), 2815, 2831, 2886, 2922, 2936, 2953, 2130, 2288, 2477, 2545	20237	
280	1050	2000	2784, 2794, 2814, 2830, 285, 2921, 2958, 2133, 2292, 2480, 2548	20238	
280	1050	1800	2829, 2884, 2920, 2957, 2134, 2293, 2481, 2550	20239	
280 ESP	1050	1800	(2792), 2883, 2928, 2961, 2181, 2298, 2391, 2485, 2556	20241	

CPL: 1856 Engine Model: M11

ENGINE POWER INFORMATION			ECM ELECTRONIC DATA PLATE INFORMATION		
HP	Torque (lb-ft)	Governed Speed	Original Software Calibration (SC) Options and Supercessions	Low NOx SC option	Notes
370	1350	2000	2791, 2804, 2825, 2841, 2896, 2943, 2117, 2278, 2465, 2529	20228	
370	1350	1800	2790, 2803, 2824, 2840, 2895, 2932, 2942, 2118, 2279, 2466, 2532	20229	
350	1350	2000	(2802), 2823, 2839, 2894, 2945, 2119, 2280, 2469, 2535	20230	
350	1350	1800	2789, 2801, 2822, 2838, 2893, 2933, 2944, 2120, 2281, 2470, 2537	20231	
330	1350	2000	(2800), 2821, 2837, 2892, 2947, 2122, 2283, 2472, 2539	20232	
330	1350	1800	2788, 2799, 2820, 2836, 2891, 2934, 2946, 2123, 2284, 2473, 2541	20233	

CPL: 1857 Engine Model: M11

ENGINE POWER INFORMATION			ECM ELECTRONIC DATA PLATE INFORMATION		
HP	Torque (lb-ft)	Governed Speed	Original Software Calibration (SC) Options and Supercessions	Low NOx SC option	Notes
310 ESP	1150	1800	2805, 2819, 2835, 2890, 2929, 2960, 2180, 2297, 2390, 2484, 2553	20240	

LOW NOx REBUILD CALIBRATION LISTING

Available From: December 1, 2000

CPL: 2036 Engine Model: M11

ENGINE POWER INFORMATION			ECM ELECTRONIC DATA PLATE INFORMATION		
HP	Torque (lb-ft)	Governed Speed	Original Software Calibration (SC) Options and Supercessions	Low NOx SC option	Notes
330	1250	1800	SC 2264	SC 20289	
330	1250	1800	SC 2261	SC 20290	
310	1150	2100	SC 2266	SC 20291	
280	1050	2100	SC 2268	SC 20292	
330	1250	2100	SC 2262	SC 20293	
310	1150	1800	SC 2265	SC 20294	
280	1050	1800	SC 2267	SC 20295	

CPL: 2037 Engine Model: M11

ENGINE POWER INFORMATION			ECM ELECTRONIC DATA PLATE INFORMATION		
HP	Torque (lb-ft)	Governed Speed	Original Software Calibration (SC) Options and Supercessions	Low NOx SC option	Notes
400	1450	1800	SC 2189	SC 20296	
370	1350	1800	SC 2191	SC 20297	
350	1350	1800	SC 2194	SC 20298	
350	1350	1800	SC 2197	SC 20299	
330	1350	1800	SC 2198	SC 20300	
370	1450	2100	SC 2190	SC 20301	
370	1350	2100	SC 2192	SC 20302	
370	1350	1800	SC 2440	SC 20303	

CPL: 2370 Engine Model: M11

ENGINE POWER INFORMATION			ECM ELECTRONIC DATA PLATE INFORMATION		
HP	Torque (lb-ft)	Governed Speed	Original Software Calibration (SC) Options and Supercessions	Low NOx SC option	Notes
330	1250	1800	SC 2601	SC 20304	
330	1250	1800	SC 2598	SC 20305	
310	1150	2100	SC 2603	SC 20306	
280	1050	1800	SC 2605	SC 20307	
330	1250	2100	SC 2599	SC 20308	
310	1150	1800	SC 2602	SC 20309	
280	1050	1800	SC 2604	SC 20310	
305	1150	2100	SC 2698	SC 20311	

CPL: 2371 Engine Model: M11

ENGINE POWER INFORMATION			ECM ELECTRONIC DATA PLATE INFORMATION		
HP	Torque (lb-ft)	Governed Speed	Original Software Calibration (SC) Options and Supercessions	Low NOx SC option	Notes
370	1350	1800	SC 2588	SC 20312	
350	1350	1800	SC 2591	SC 20313	
350	1350	1800	SC 2594	SC 20314	
330	1350	1800	SC 2595	SC 20315	
370	1450	1800	SC 2587	SC 20316	
330	1350	2100	SC 2589	SC 20317	
330	1350	2100	SC 2596	SC 20318	
420	1450	2100	SC 2620	SC 20319	
370	1350	1800	SC 2621	SC 20320	
370	1350	1800	SC 2627	SC 20321	
335	1350	2100	SC 2631	SC 20322	

Attachment B: Replacement Fuel Injector

Cummins Critical Parts List and Injector Part No.	
CPL	ReCon Injector No.
1855, 1856, 1857	3087557 PX
2036, 2037, 2370, 2371	3411753 PX

Attachment C: Diesel Particulate Filter

Particulate Filter Part No.	
Particulate Filter	Cleaire No.
Johnson Matthey CRT	5200 to 5299 series
Engelhard DPX	5300 to 5399 series

EVALUATION SUMMARY

Manufacturer Name: Cleaire Advanced Emission Controls

Name of Device: Flash and Match and Flash and Catch Diesel Retrofit Systems

Background:

Cleaire Advanced Emission Controls (Cleaire) of 14775 Wicks Boulevard, San Leandro, California 94577 has requested exemption of its *Flash and Match* and *Flash and Catch* diesel retrofit systems from the prohibitions in section 27156 of the California Vehicle Code (VC). The systems are designed for use on 1993 through 1998 model-year Cummins M11 heavy-duty diesel engines. The exemptions apply to the engines and low NOx software calibrations Cummins has identified in its "Low NOx Rebuild Calibration Listing." In addition, the exemptions are only valid provided that the following conditions are met: (1) the replacement fuel injectors are Cummins ReCon PX injectors remanufactured to meet Cummins' original equipment manufacturer (OEM) specifications; (2) for the *Flash and Match* system, the oxidation catalyst is identical to the catalyst used in Cummins' 2001 model-year OEM ISM bus engines; and (3) for the *Flash and Catch* system, the filter is Engelhard Corporation's DPX Catalyzed Soot Filter or Johnson Matthey's CRT Particulate Filter exempted by the ARB and is used only on engines that meet the operating conditions (i.e. particulate matter emission level, NOx to PM ratio, engine exhaust temperature, and diesel fuel sulfur level) specified by Engelhard Corporation and Johnson Matthey.

Recommendation:

Grant exemption to Cleaire as requested and issue Executive Orders D-535 and D-535-1.

Device Description:

Cleaire's *Flash and Match* and *Flash and Catch* systems are exhaust emission control devices designed primarily to reduce oxides of nitrogen (NOx) and particulate matter (PM) emissions from diesel engines. It also reduces hydrocarbon and carbon monoxide emissions from diesel engines. The *Flash and Match* system consists of re-programming of the electronic control module (ECM), replacement fuel injectors, and a diesel oxidation catalyst. The *Flash and Catch* system consists of the same ECM re-program and replacement injectors but instead of the catalyst includes a diesel PM filter. The system components are identified in Attachments A, B, and C of Executive Orders D-535 and D-535-1.

The ECM re-program is identical to the calibration change required under Cummins' Consent Degrees with the United States Environmental Protection Agency (U.S. EPA) and the Air Resources Board (ARB). The calibration retards fuel injection timing to reduce NOx emissions during highway operations. The low NOx software calibrations and the applicable engines are identified in Cummins' "Low NOx Rebuild Calibration Listing" (Attachment A). The replacement injectors are Cummins ReCon PX injectors, remanufactured to meet Cummins' OEM specifications. The catalyst is manufactured by Engelhard Corporation and canned by Fleetguard Nelson. It is identical to the catalytic muffler used in Cummins 2001 model-year OEM ISM bus engines. The catalyst measures 9.5 inches in diameter and 12 inches in length is

identified by Cummins part number 3926265 and Fleetguard Nelson part number 27112.

The PM filters used in the *Flash and Catch* system include Engelhard Corporation's DPX Catalyzed Soot Filter and Johnson Matthey's CRT Particulate Filter. Both filters are passive, continuously regenerating cordierite wall-flow filters. The DPX filters are exempted under Executive Orders D-384-5, D-384-6, and D-384-7, and the CRT filters are exempted under Executive Order D-393-3. Exemption of the *Flash and Catch* system is valid provided that the engines meet the following conditions: (1) the engines were originally certified to meet a PM emission standard of 0.10 grams per brake-horsepower-hour or lower; (2) the engine exhaust temperature is greater than or equal to 225° C (DPX filter) or 275° C (CRT filter) for 40 to 50 percent of the duty cycle; (3) NOx to PM ratio is at least 8 (CRT filter) ; and (4) the engine is operated using diesel fuel with a maximum sulfur content of 50 parts per million by weight.

Discussion/Basis for the Recommendation:

The ECM calibration change has already been evaluated and approved by the U.S. EPA and the ARB under the Consent Decrees. Under the Consent Decrees, Cummins is required to ensure that the calibration results in lower highway NOx emissions (steady-state emissions) and does not cause any increases in emissions for all other regulated pollutants. The replacement fuel injectors are remanufactured to meet Cummins OEM specifications, and the oxidation catalyst is identical to the one certified on Cummins 2001 model-year new ISM bus engines. To further demonstrate that the system has no adverse impact on emissions, Cleaire conducted chassis dynamometer emission testing with the *Flash and Match* system. Comparison of baseline and modified emissions during Urban Dynamometer Driving Schedule showed that the *Flash and Match* system does not have any significant adverse impact on the vehicle's transient emissions.

Cleaire did not provide any emission data for the *Flash and Catch* system. However, based on the emission results of the *Flash and Match* system and based on the ARB's previous evaluations of PM filters, it was concluded that replacing the catalyst with a PM filter would not result in any adverse emission impact. As a result, it is concluded that the *Flash and Match* and *Flash and Catch* systems meet the requirements for a VC 27156 exemption for the engines listed in the Executive Order.