

**State of California  
AIR RESOURCES BOARD**

**EXECUTIVE ORDER DE-07-006**

Pursuant to the authority vested in the Air Resources Board by Health and Safety Code, Division 26, Part 5, Chapter 2; and pursuant to the authority vested in the undersigned by Health and Safety Code Section 39515 and 39616 and Executive Order G-02-003;

Relating to Verification under Sections 2700 through 2710 of Title 13 of the California Code of Regulations

Vycon, Inc.  
REGEN System

The California Air Resources Board (ARB) staff has reviewed Vycon's request for verification of their flywheel based energy storage device, REGEN. Based on an evaluation of the data provided, and pursuant to the terms and conditions specified below, the Executive Officer of the ARB hereby finds that the Vycon REGEN reduces emissions of diesel particulate matter (PM) consistent with a Level 1 device (greater than or equal to 25 percent reduction) (Title 13 California Code of Regulations (CCR) Sections 2702 (f) and (g) and Section 2708), reduces oxides of nitrogen (NO<sub>x</sub>) by 30 percent, and complies with the CARB January 1, 2009, NO<sub>2</sub> limit (Title 13 CCR Appendix A Section 2702 (f) and Section 2706 (a)). Accordingly, the Executive Officer determines that the Vycon REGEN merits verification as a Level 1 Plus system and reduces NO<sub>x</sub> by 30 percent for diesel engines on rubber tired gantry cranes (RTG), subject to the terms and conditions specified below.

This verification is subject to the following terms and conditions:

- The engine must be used in a rubber tired gantry crane.
- The engine is greater than 50 horse power.
- The engine must be an off-road engine.
- The engine must be in its original certified configuration.
- The engine can be a two or four-stroke.
- The engine can be turbocharged or naturally-aspirated.
- The engine should be well maintained and not consume lubricating oil at a rate greater than that specified by the engine manufacturer.
- The other terms and conditions specified in Table 1 below.

<b>Table 1: Summary of Conditions for the Vycon REGEN System</b>	
<b>Parameter</b>	<b>Value</b>
Applications	Rubber Tired Gantry Cranes powered by diesel generator(s)
Technology	Hybrid flywheel energy storage system
PM Verification Level	Level 1 Plus <ul style="list-style-type: none"> <li>• PM - at least 25% reduction</li> <li>• NO<sub>x</sub> – at least 30% reduction</li> <li>• NO<sub>2</sub> - meets January 2009 limit</li> </ul>
Engine Type	Diesel-fueled off-road engines, with or without a turbocharger.
Engine Model Years	Pre-1996 or Tier 1, Tier 2, or Tier 3.
Engine Horsepower	Greater than 50 hp
Fuel	California diesel fuel with less than or equal to 15 ppm sulfur or a biodiesel blend provided that the biodiesel portion of the blend complies with ASTM D6751, the diesel portion of the blend complies with Title 13 (CCR), sections 2281 and 2282, and the blend contains no more than 20 percent biodiesel by volume.
Minimum Exhaust Temperature for Filter Regeneration	NA. Hybrid flywheel energy storage system
Maximum consecutive minutes at idle	NA.
Number of Cold Start and 30 Minute Idle Sessions before Regeneration Required	NA.
Number of Hours of Operation Before Cleaning of Filter Required	NA.

That installation of the Vycon REGEN has been found not to reduce the effectiveness of the applicable vehicle pollution control system, and therefore, the REGEN is exempt from the prohibitions in Section 27156 of the Vehicle Code for installation on heavy-duty off-road vehicles. This exemption is only valid provided the engines meet the aforementioned conditions.

The Vycon REGEN system consists of a flywheel based energy storage device that captures regenerated power of a container lowering cycle of an RTG crane and returns this power during a high load lifting cycle to reduce peak loads on the diesel fueled generator set.

This Executive Order is valid provided that installation instructions for Vycon REGEN do not recommend tuning the engine to specifications different from those specified by the engine manufacturer.

No changes are permitted to the device unless approved by the ARB. ARB must be notified in writing of any changes to any part of the Vycon REGEN and these changes must be evaluated and approved by ARB. Failure to report any changes shall invalidate this Executive Order.

Changes made to the design or operating conditions of Vycon REGEN system which adversely affect the performance of the engine's existing pollution control system shall invalidate this Executive Order.

Marketing of the Vycon REGEN 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 without prior approval from ARB.

As specified in the Diesel Emission Control Strategy Verification Procedure (Title 13 CCR Section 2706 (g)), the ARB assigns each Diesel Emission Control Strategy a family name. The designated family name for the verification as outlined above is: **CA/VYC/2007/PM1+/N30/OFF/SYS01**

Additionally, as stated in the Diesel Emission Control Strategy Verification Procedure, Vycon, Inc., is responsible for honoring their warranty (Section 2707) and conducting in-use compliance testing (Section 2709).

In addition to the foregoing, ARB reserves the right in the future to review this Executive Order and the verification provided herein to assure that the verified system continues to meet the standards and procedures of California Code of Regulations, Title 13, Section 2222, et seq and California Code of Regulations, Title 13, Sections 2700 through 2710.

Systems verified under this Executive Order shall conform to all applicable California emissions regulations.

Violation of any of the above conditions shall be grounds for revocation of this Executive Order.

Executed at Sacramento, California, this 3<sup>rd</sup> day of October, 2007.

Tom Cackette  
Acting Executive Officer  
by

/s/

Robert Fletcher, Chief  
Stationary Source Division