



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Washington, DC 20460

OFFICE OF
AIR AND RADIATION

Mr. Greg Hoenert
Caterpillar Inc.
100 NE Adams St.
Peoria, Illinois 61629-7250

Dear Mr. Hoenert:

The U.S. Environmental Protection Agency (EPA) has reviewed your request for verification of the Caterpillar Inc. (Caterpillar) 3500 Series Marine Engine Emissions Upgrade Group (EUG) Kits. The Caterpillar 3500 Marine Engine EUG Kits are upgrades for certain mechanical unit injectors (MUI), electronic unit injectors (EUI), Tier 1 and Tier 2 Caterpillar engines to achieve Tier 3 emission levels. Upgrades are typically performed at the time of engine rebuild. Caterpillar's 3500 Series Marine Engine EUG Kits includes a new turbocharger, pistons, valve mechanism, injectors, electronic controls, and other components. Based on our evaluation of the verification application, the test data, and additional information provided, EPA hereby verifies that this technology reduces emissions to achieve the Tier 3 level.

The technology is approved for use on the following engines and/or equipment provided all of the operating criteria are met as described below:

Technology	Engine Model/Application	Fuel, Max Sulfur (ppm)	Reductions (%)			
			PM	NO _x	HC	CO
Marine Engine Emissions Upgrade Group Kit #7 (Tier 2 to Tier 3)	Caterpillar 3512 and 3516 (large cam bore) diesel engines for non-road, marine applications, model year 1994 and newer, originally equipped with Tier 2 engines and rated at 1600 or 1800 rpm (varies by model)	15	Tier 3 Level (marine)			

Technology	Engine Model/Application	Fuel, Max Sulfur (ppm)	Reductions (%)			
			PM	NOx	HC	CO
Marine Engine Emissions Upgrade Group Kit #8 (Tier 1 to Tier 3)	Caterpillar 3512 and 3516 (large cam bore) diesel engines for non-road, marine applications, model year 1994 and newer, originally equipped with Tier 1 engines and rated at 1600 or 1800 rpm (varies by model)	15	Tier 3 Level (marine)			

Technology	Engine Model/Application	Fuel, Max Sulfur (ppm)	Reductions (%)			
			PM	NOx	HC	CO
Marine Engine Emissions Upgrade Group Kit #9 (EUI to Tier 3)	Caterpillar 3512 and 3516 (large cam bore) diesel engines for non-road, marine applications, model year 1994 and newer, originally equipped with electronic unit injectors (EUI) and rated at 1600 or 1800 rpm (varies by model)	15	Tier 3 Level (marine)			

Technology	Engine Model/Application	Fuel, Max Sulfur (ppm)	Reductions (%)			
			PM	NOx	HC	CO
Marine Engine Emissions Upgrade Group Kit #10 (MUI to Tier 3)	Caterpillar 3512 and 3516 (large cam bore) diesel engines for non-road, marine applications, model year 1994 and newer, originally equipped with mechanical unit injectors (MUI) and rated at 1600 or 1800 rpm (varies by model)	15	Tier 3 Level (marine)			

This technology is approved for Caterpillar 3500 Series marine engines with rated power greater than 600 horsepower originally manufactured for 1994 model years and newer with rated speeds at 1600 or 1800 rpm. Please note that this verification is based on the ISO 8178 E3 general marine duty cycle. The following criteria must be met in order for appropriately retrofitted engines to achieve the aforementioned emission reductions:

1. The servicing dealer must follow specific installation instructions approved by Caterpillar and validate that the upgraded engine has the necessary components installed and has been tested to ensure the proper fuel delivery, power, torque and speed. The dealer must submit a validation form to Caterpillar in order to receive a label for the upgraded engine.
2. The original Caterpillar 3500 Marine Engine includes mechanical unit injectors (MUI), electronic unit injectors (EUI), Tier 1 or Tier 2 engine. The electronic control module (ECM) must be replaced or updated as part of the upgrade. The primary critical new

components are turbocharger, pistons, valve mechanism, injectors, electronic controls, and other installation parts as necessary.

3. The engine must be operated on ultra-low sulfur diesel fuel (ULSD) of 15 ppm or less.
4. This verification is for engines used in vessels with variable speed propulsion systems and is not applicable for engines used in recreational or constant speed propulsion applications.

Vessel owners who use these kits must be made aware of EPA's 2008 Locomotive and Marine Engine Regulations which cover existing marine diesel engines that are upgraded, remanufactured, or rebuilt. This mandated measure, referred to as EPA's Marine Remanufacture Program, requires a vessel owner to use an EPA certified remanufacture system at the time of engine upgrade, of a specific marine engine, if available. Caterpillar is obligated to inform vessel owners if any certified remanufacture system is available for their engine. If not, and the above criteria listed is met, then the verified 3500 Marine Engine EUG Kit #7, #8, #9 or #10 can be applied. If a certified remanufacture system exists, then this verified technology does not qualify for EPA grant funding, and the owner must use a certified system in accordance with applicable regulations. More information about EPA's Marine Remanufacture Program can be found on: <http://www.epa.gov/otag/marine.htm>.

If Caterpillar's 3500 Marine EUG kits are modified from the application description provided to EPA, you must notify EPA immediately. This verification does not automatically confer to modified devices or devices that are similar to this original verification.

Information on the Caterpillar 3500 Marine EUG Kit #7, #8, #9 and #10 will be posted on the EPA's Verified Technology List website at: <https://www.epa.gov/verified-diesel-tech/verified-technologies-list-clean-diesel>. Caterpillar will be responsible for completing the required in-use testing program and for submitting all in-use testing data to EPA as outlined in EPA's in-use test methods.

Thank you for participating in EPA's Technology Assessment Center Verification Program. If you have any questions or comments, please contact Kuang Wei, of my staff, at 202-343-9329.

Sincerely,

Karl Simon, Director
Transportation and Climate Division
Office of Transportation and Air Quality