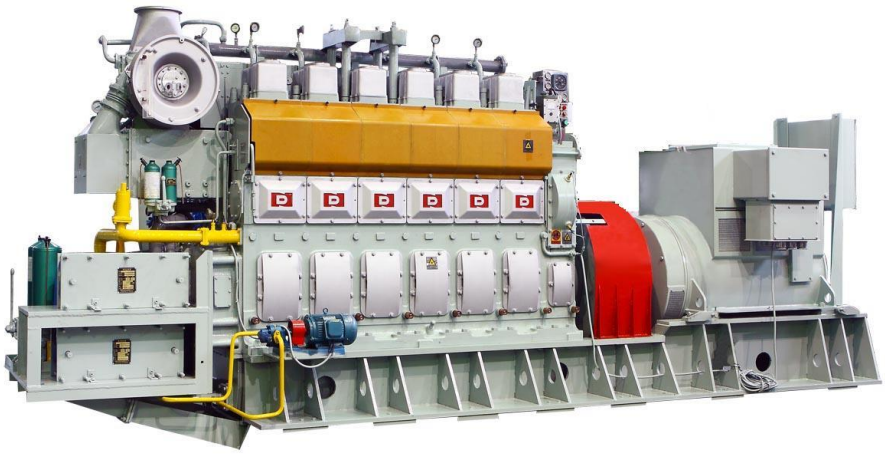
EnerBurn® Usage in Low and Medium Speed Diesel Gensets



The EnerBurn Catalyst

EnerBurn is a fuel-borne catalyst, now owned and manufactured by EnerTeck Chemical Corporation. It is registered with the EPA and was originally developed by Esso Labs and marketed by the joint venture between Exxon and Nalco Chemical Corporation. The catalyst provides three primary benefits once the equipment is fully conditioned (the conditioning period is roughly 1000 hours of operation)

1. Improvement in fuel efficiency (reduction in fuel consumption)
2. Substantial reduction of emissions
3. Reduction of engine wear and degradation

The technology is very easily implemented and monitored. The catalyst is delivered to the engine via the fuel. EnerBurn is mixed at a very specific ppm upon delivery of the fuel via chemical injection equipment. Our injection equipment is currently manufactured and designed by Hammonds (hammondscos.com), a leader in chemical injection equipment.

Deployment of the injection equipment unit is site dependent and can vary greatly depending on the size of the fuel tank farm at a given location. A typical injection equipment site is shown in the image below

Injection Setup for 100,000 gallon plus fuel tank farm with bulk EnerBurn storage

How it works

EnerBurn works by setting a nano-scale catalytic surface inside the combustion chamber. This enables the burn rate of the fuel to double, the result of which is a complete burn of the fuel provided for each power cycle. As the fuel is more completely burned, the natural result is that normally unburned hydrocarbons (HC's) are burned earlier on crank angle thereby converting from waste heat and unburned HC's into work. This results in a lower exhaust temperature, by about 50°F, which proves that work is being produced rather than heat that otherwise would be exhausted out the stack. It is a proven fact that lower combustion temperatures result in lower NOx and more burned HC's results in less particulate matter being exhausted out the stack. The more complete burn of the fuel provided per cycle results in more pressure earlier on crank angle which increases the work achieved per given amount of fuel, resulting in a fuel efficiency improvement of approximately 7-9% depending on the application.

In a diesel engine, the combustion temperature of carbon (soot) is approximately 1050° F. Using EnerBurn the combustion temperature of carbon is reduced to approximately 750° F. Reduction of carbon in the engine combustion chambers and crankcase will substantially improve engine wear leading to much longer equipment life and less maintenance. Lower carbon also results in less soot available to foul parts such as turbocharger fan blades, pistons, rings etc., this furthers performance improvement by allowing the parts to function as designed.

The combustion process starts like kindling in a fire, the small molecules burn first; then progressing to the larger molecules. **Without** the presence of the EnerBurn catalyst, the larger molecules never get a

chance to burn because the burn rate of fuel is too slow. This leaves many unburned hydrocarbons which remain in the chamber as soot. The more fuel that can be burned, prior to the quenching effect of the rapid expansion of the combustion chamber as the piston moves downward, the better the end result of soot reduction and fuel economy.

Improvement expectations for low and medium speed generators

When using Bunker C or other HFO's these are the ranges of expected results

- Fuel consumption reductions of 7-9%
- NOx reductions of approximately 11-15%
- Particulate Matter reductions of 50-60%
- Lube Oil consumption will be reduced by 18-25%
- Engine wear will improve dramatically
- Less maintenance will be required as the equipment will operate much more efficiently

Proving out the benefits

In order to properly evaluate whether or not EnerBurn is providing the benefits claimed we enlist a third party engineering firm to run the evaluation and analyze the results. JEI Power (jeipower.com) is the engineering firm and its principal, Gerry Janelle, designed the protocols to evaluate EnerBurn.

For generators the process involves the following;

Prior to the introduction of the catalyst

- Sampling and analysis of the fuel
- Baselining of the generator for fuel consumption and shp at various loads and rpm's
- Baselining of NOx, SOx, CO, CO2 and PM's at various loads and rpm's
- Baselining of the engine operating and exhaust temperatures.
- Video of stack exhaust at normal operation rpm and power

After introduction of the catalyst and during the evaluation period

- Sampling of the fuel to ensure consistency with pre-evaluation fuel
- Recording of data from the genet ECM's, if available as secondary data collection for later analysis

Upon completion of the evaluation period

- Benchmarking of the generator for fuel consumption and shp at the same loads and rpm's used in the baselining process
- Benchmarking of NOx, SOx, CO, CO2 and PM's at the same loads and rpm's used in the baselining process
- Benchmarking of the engine operating and exhaust temperatures.
- Video of stack exhaust at normal operation rpm and power

The benchmark data will then be compared to the baseline data and the data analysis report will be completed by JEI.