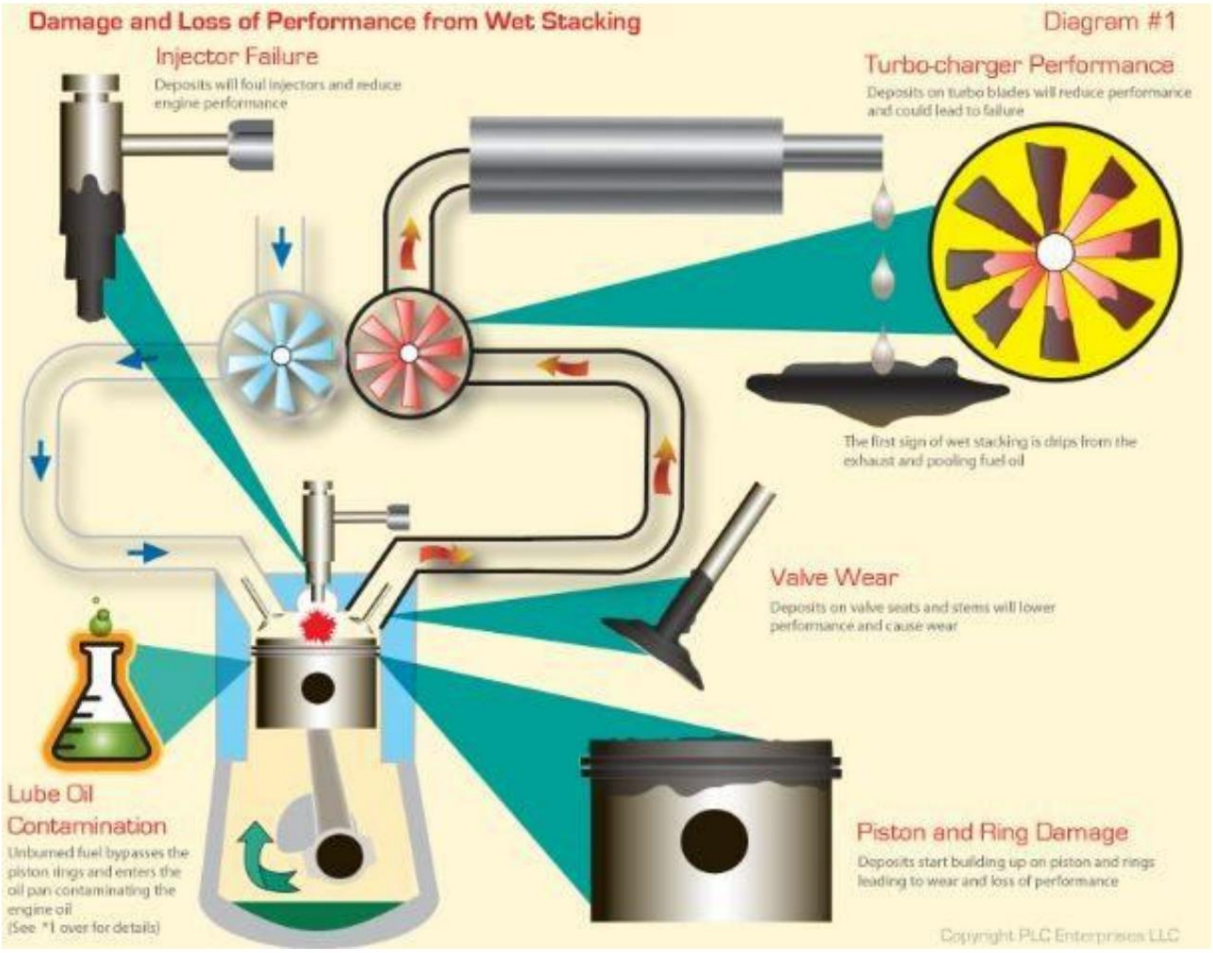
ENGINE FAILURE AT UNDERLOAD



All diesel generators are prone to soot deposits (wet stacking) resulting in performance issues when operating under load for extended periods of time. We see a typical phenomenon on construction sites where an oversized generator operates a construction crane. Once the crane is not working, the same generator runs for too low a load, a refrigerator, a sawing machine or some lamps, with all the consequences for the life of the engine.

Euro-5 engines are then even more vulnerable to the effects of soot deposits than older models.

Long story short? Underloaded EURO-5 generators lead to wet stacking and serious maintenance problems. The best way to avoid this is to size your generator correctly. This is not always obvious, as we explain here.

A QUICK INTRODUCTION TO SOOT DEPOSITION

Soot deposit refers to the buildup of unburned fuel on the cylinder walls and throughout the exhaust system. You can detect this visually by searching for a species

thick, black liquid in the exhaust pipe, a wet exhaust usually reveals this problem. This greasy carbon deposit is the combination of unburned fuel (soot) and exhaust fumes.

Cause: Generator underload.

Generators must operate at relatively high temperatures to fully vaporize and burn diesel. At light loads, less fuel is atomized in the combustion chamber, less heat is generated and part of the fuel remains unburned.

The unburned fuel then travels to the exhaust system as carbon and contaminates the valves, turbocharger and tailpipes with soot, causing poor performance and premature wear of these components and the engine in general.
It can also clog the injectors, compromising the ability to inject enough fuel into the combustion chamber. Affected injectors inject droplets, not atomized mist into the combustion chamber. Consequence droplets do not burn as efficiently. This, in turn, lowers the combustion temperature further and allows more unburnt fuel to migrate into the exhaust system.

In this way, the presence of soot deposits results in further wet build-up - causing increasingly serious engine damage over time. Eventually, if left undetected, it will escalate to permanent damage or complete engine failure.

EURO-5 generators even more sensitive to soot deposits

In the 1990s, the European community started phasing out emission regulations for diesel generators, among other things. As you know by now, the most recent EURO-5 is mandatory for most generator applications, which aim to reduce particulate matter (PM) and nitrogen oxides (NOx) emissions by 90% .
To comply with these regulations, diesel technology had to change radically.
And although the improvements in the engine and the addition of advanced emission control systems have made the EURO-5 diesel engines more efficient . Have they also made these motors more vulnerable to the effects of underload.
One such improvement that affects this is the exhaust gas recirculation system in the after-treatment system of most Euro-5 engines. It returns part of the exhaust gases to the combustion chamber, which replaces part of the oxygen with carbon dioxide and lowers the peak combustion temperature.
This promotes the overall fuel efficiency of the engine, and it even reduces cooling needs, making the radiator smaller.
But it also means that the EURO-5 has to work under higher load, optimal is at least 75% of the standby power, and preferably never below 60%. To reach the temperatures necessary to prevent soot build-up . Underloading seriously jeopardizes the life of the generator .

DIMENSION THE GENERATOR CORRECTLY

Preventing soot deposits starts with correctly sizing your generator.
And the most important sizing advice we can give is this:
Don't let the choice be to overpower your generator.

At first glance, it seems logical that a 100 kW generator is a safe option for an application requiring 40-50 kW of continuous power. After all, a 100kW unit gives you the flexibility to add more load if needed.
But oversizing your application in this way guarantees that your generator will run underload by continuously running it at 40-50% capacity. Over a (short) time, this will lead to soot deposits, resulting in premature engine wear and system failures. Consult with us to avoid underload, usually a PM alternator https://javac.eu/product/nanomag-alternator/ Mean the ultimate solution and thus prevent soot deposits . A general guideline is that you add the starting power *(the power needed to start engines)* and the continuous power of all equipment you load on the generator and then provide a buffer of 10%.

This results in the selection of a generator that meets your power needs and does not wear out prematurely. With a Javac PM alternator you avoid this kind of problem in most cases and you significantly reduce the oversizing capacity of the generator

WHAT ARE CAUSES OF SOOT DEPOSITION?

Like all internal combustion engines, to operate at maximum efficiency, a diesel engine must have just the right air-fuel ratio and be able to maintain the designed operating temperature for complete combustion of fuel. When a diesel engine is operated at too light loads, it will not reach the correct operating temperature. When the diesel engine runs below its specified operating temperature for an extended period of time, unburnt fuel builds up in the exhaust and is noticed as wetness in the exhaust system, hence the term "soot deposit".

THE EFFECTS OF SOOT DEPOSITION

As unburned fuel is exhausted from the combustion chamber, it begins to build up in the exhaust side of the engine, resulting in fouled injectors and a buildup of carbon on the exhaust valves, turbocharger and muffler.
Excess deposits can lead to a loss of engine performance as gases bypass the valve seats, exhaust buildup produces back pressure and deposits on the turbo blades reduce turbo efficiency.
Permanent damage will not be sustained over short periods, but over longer periods these deposits will cause damage and erode vital engine surfaces. Even when engines are running below the designed operating temperature, the piston rings do not expand enough to sufficiently seal the space between the pistons and the cylinder walls. This results in unburned fuel and gases escaping into the oil pan and reducing the viscosity of the oil, leading to premature engine wear. In addition, the AD blue additive will cause additional problems in the exhaust system under load

AVOIDING SOOT DEPOSITION IS ESSENTIAL

In addition to the adverse engine effect, the user of a system must take into account:
Additional costs. Excessive soot build-up will shorten engine life by many years and many years before scheduled replacement.
Pollution: Many urban areas limit the level of smoke emissions that wet pile causes.

Power: Even before an engine is damaged, deposits will reduce maximum power. A prematurely worn engine will have a lower maximum power than what it was essentially designed for.
Maintenance - An engine that develops wet-pile will require significantly more maintenance than one that has been properly loaded.

oh .

SOOT DEPOSIT SOLUTIONS

The simplest solution is to always run the Generator Sets with an electrical load that reaches the diesel's designed operating temperature, or about 75 percent of full load. Built up fuel deposits and carbon can be removed by running the diesel engine at the required operating temperature for several hours if the wet stack has not yet reached the level. The constantly higher load on the generator leads to a significantly higher fuel consumption. This increased cost must be weighed against the maintenance cost of the generator.

FINAL CONCLUSION

The most common problem of soot deposition occurs on construction sites where oversizing for operating the tower crane by a factor of 3 or more is the rule rather than the exception. If you switch to a PM alternator, this problem is largely obviated. Not only consumption drops, maintenance drops significantly, logistics costs decrease, and finally you invest in a more environmentally friendly generator than a conventional