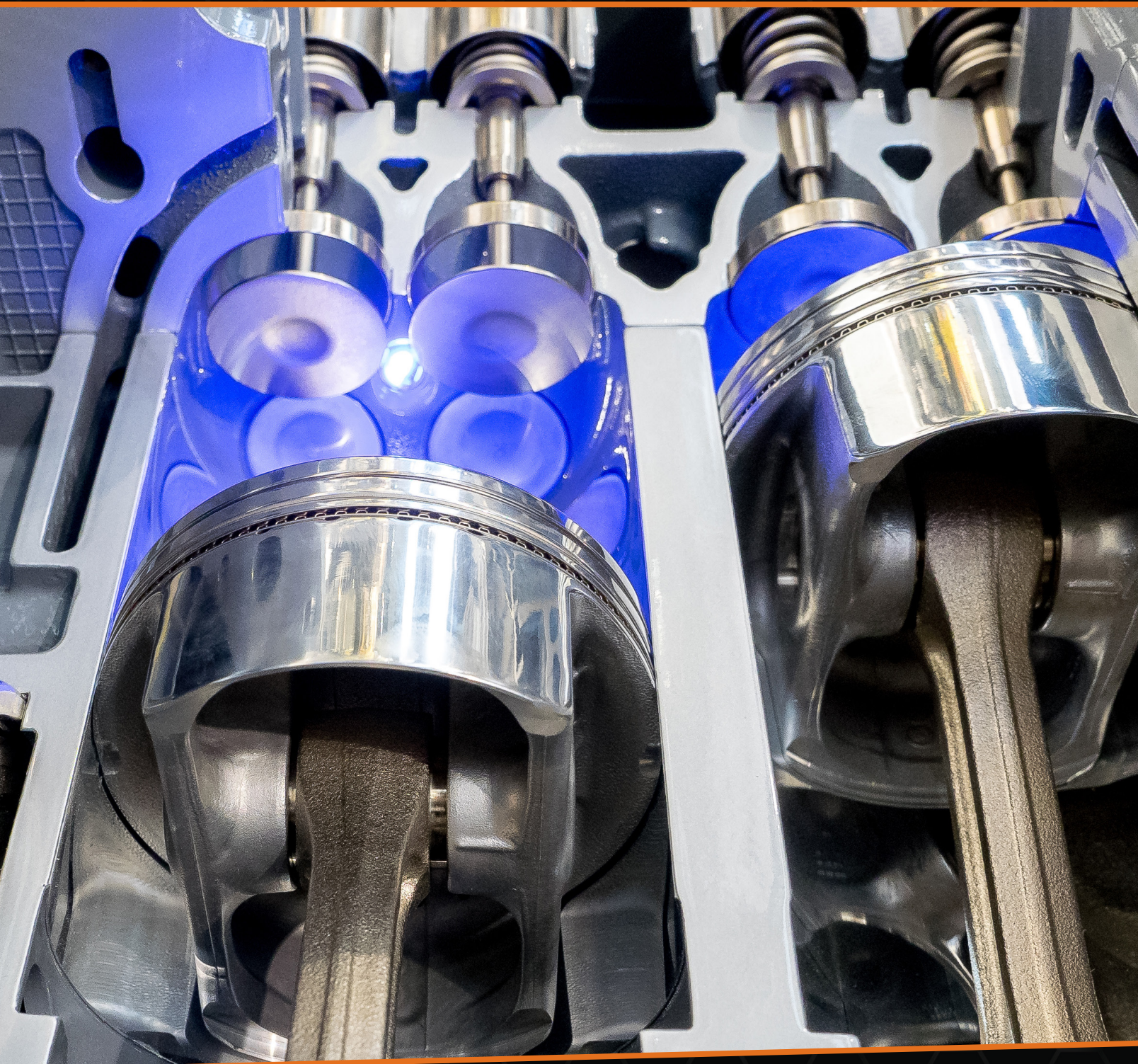


DIESEL ENGINE

WET STACKING FACT SHEET



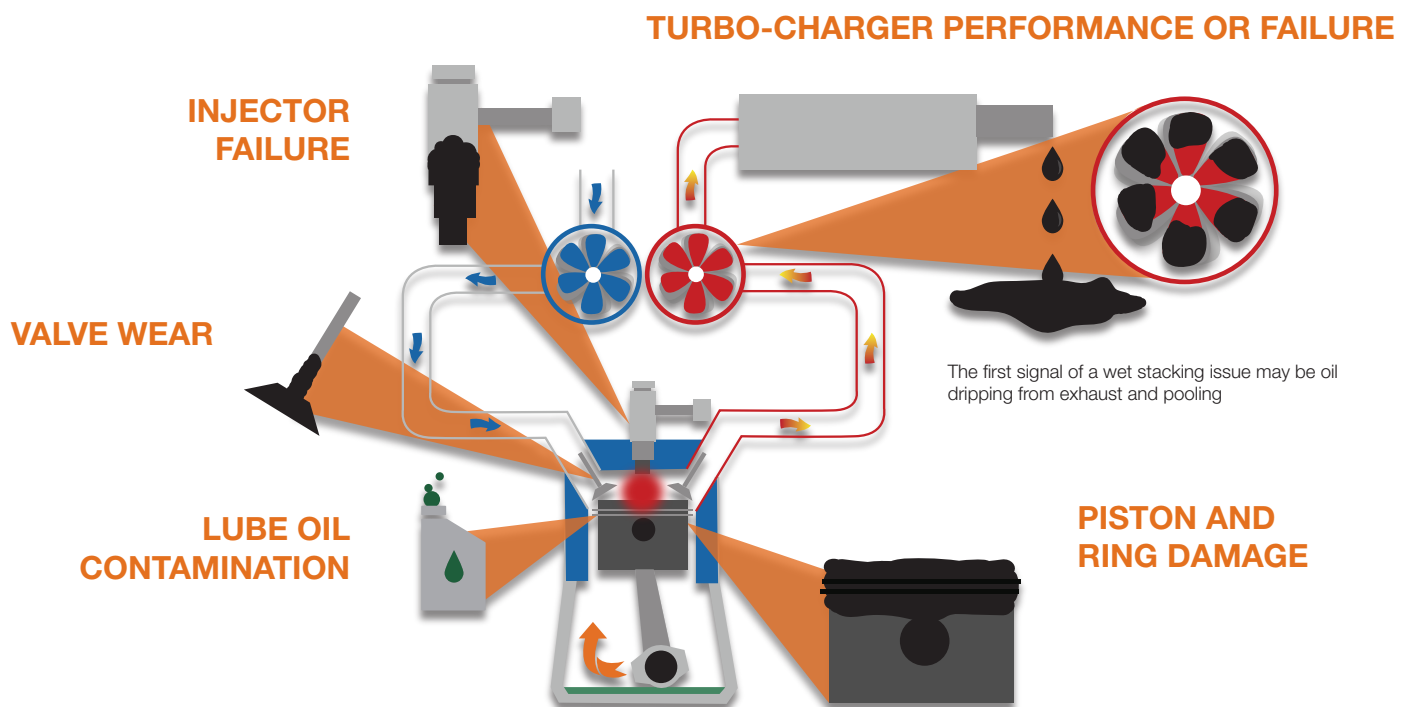
Those who work with diesel engines or equipment powered by diesel engines, are familiar with the condition of “wet stacking.” This condition in a diesel engine has become a particular issue due to technologies and components involved with reducing particulate matter (PM) and nitrogen oxides (NOx) emission levels to meet ever-changing Environmental Protection Agency (EPA) regulations. Over the past decade, as engine manufacturers started to introduce technologies to mitigate emissions, like diesel oxidation catalysts (DOC), selective catalytic reduction (SCR) and components like diesel particulate filters (DPF), wet stacking started to become an annoying and real issue, with significant cost implications.

WHAT IS “WET STACKING”?

For any modern engine to operate efficiently, that engine needs to have the ideal air-to-fuel mixture and must be able to sustain the ideal running temperature for a complete fuel burn. Diesel engines are built to work hard and get hot. If a diesel engine is not required to deliver at least 30% of its rated horsepower, it may have difficulty attaining an optimal operating temperature. “Wet stacking” is a phenomenon that occurs when unburned diesel fuel builds up within the exhaust side of the engine, which fouls fuel injectors and builds carbon on valves and within the turbocharger. This occurs most frequently when the diesel generator is consistently operated on a load under 30%, which occurs when a diesel generator is improperly sized, or oversized for the application. A diesel engine operating under a light load for a sustained period of time may experience wet stacking. Engines that experience wet stacking will require considerably more maintenance, including periodic artificial “load-banking” and cleaning and repair. The reason load-banking works is because it forces the generator to operate a full load to burn off the accumulated build-up. So, when you consider the fact that the load is necessary to create the heat to burn off build up, then you start to understand that **proper engine heat is really the condition necessary to avoid wet stacking** and proper loading is just the catalyst.

ISSUES CAUSED BY WET STACKING

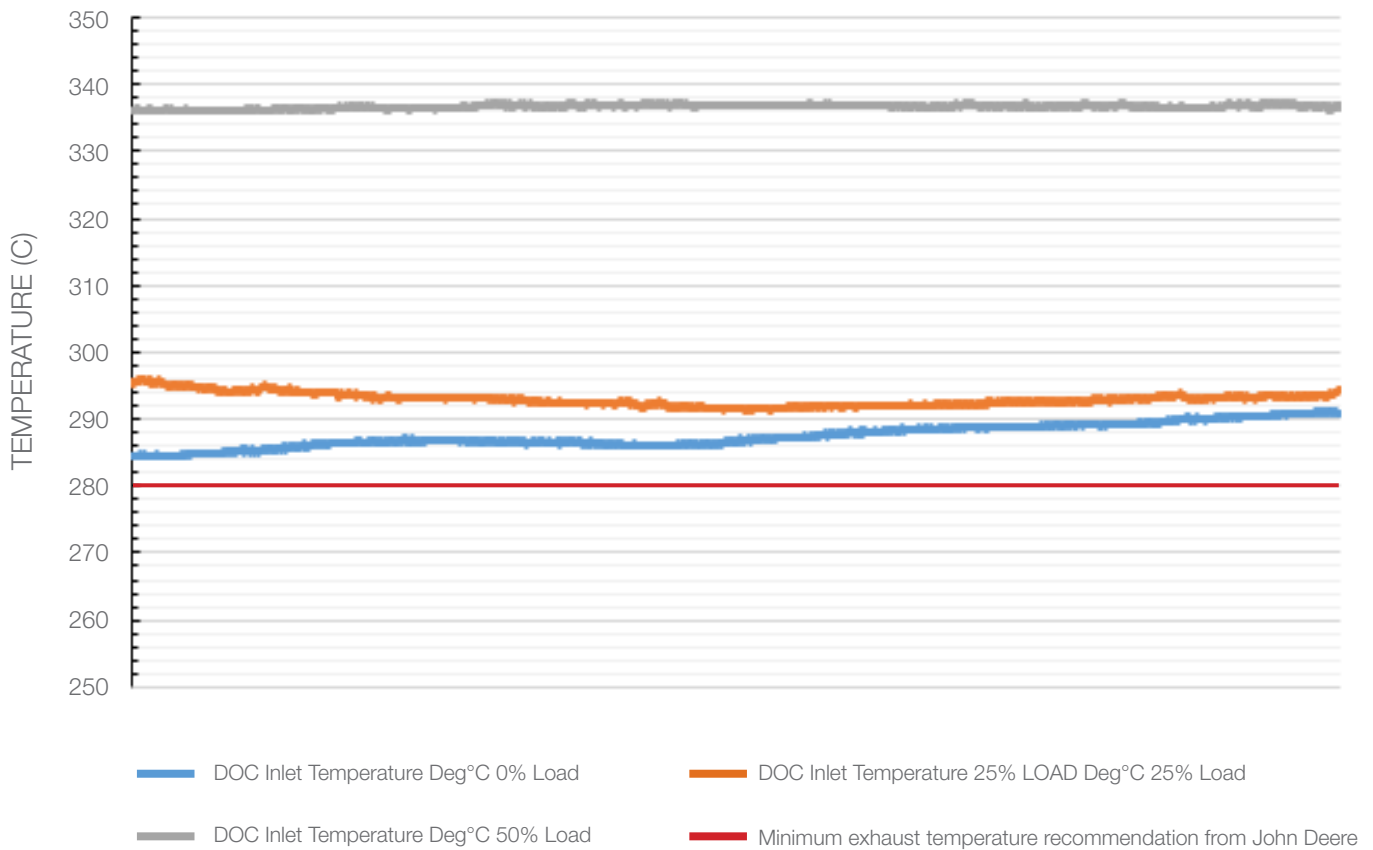
As mention previously, wet stacking can cause quite a few issues within the diesel engine. The infographic below illustrates the major problems.



EXHAUST TEMPERATURE

As a leader in prime power generation, Generac Mobile is on the leading edge of engine technologies that meet emissions standards while also being easy-to-use and maintain for the end user, including engines and technologies to minimize wet stacking issues. **The John Deere diesel engines used in Generac Mobile's Final Tier 4 mobile generators are designed to resist wet stacking.**

John Deere's latest Final Tier 4 diesel engines feature an **exhaust temperature management (ETM) system**. This system works by monitoring and regulating engine exhaust temperatures and providing supplemental heat when necessary. In fact, we performed a test with our MDG175 mobile generator equipped with a John Deere diesel engine. Our testing shows that **John Deere's ETM is quite effective at regulating engine exhaust temperature**, keeping it at above the 280°C (536°F) temperature, regardless of load. The graph below shows results of engine temperatures under 0%, 25% and 50% load. As one can see, the exhaust heat stays consistently above John Deere's minimum recommended heat level of 280°C (536°F), at each load level tested – including 0% load or idle.



Test results show that engine exhaust temperature remained above the minimum recommended temperature threshold, regardless of load.

SUMMARY

So, while proper generator sizing, and running the generator and engine under a proper minimum load is important and necessary for optimal generator performance, it is also important to note the technologies the engine manufacturer is utilizing. **Generac Mobile generators with Final Tier 4 John Deere engines feature Deere's ETM system that regulates and maintains appropriate engine exhaust temperature to burn off excess engine fluids and avoid wet stacking.**

TIPS FOR OPTIMIZING GENERATOR PERFORMANCE

KNOW YOUR POWER NEEDS – in order to select the right generator for your prime power needs, you need to know your engine motor starting and load requirements. Make sure the generator you choose for the application will have proper minimum load and enough power to accommodate initial motor starting needs.

PERFORM REGULAR MAINTENANCE – Whether you rent or own your equipment, it is important to regularly service your engine, including oil, oil filters and air filters. Each engine manufacturer is different. To ensure that you are meeting your minimum engine maintenance requirements, consult the owner's manual. Performing recommended maintenance ensures optimal equipment performance and maximizes fuel efficiency.

CONSIDER AMBIENT TEMPERATURES – If operating in extreme high or low ambient temperatures, it is important to know the temperature parameters of the equipment. Generac Mobile offers a variety of cold weather options for its generators that allow for operation in extreme cold temps down to -40°C.

ARTIFICIAL LOAD / WET STACKING AVOIDANCE DEVICES – A number of diesel engine and equipment manufacturers offer optional “artificial load” or “supplemental heat” devices to maintain optimal load and heat conditions within the engine and exhaust. While not all engines require or even benefit from such devices, such devices may offer a level of assurance that the diesel engine won't succumb to wet stacking. Before opting for such a device, Generac Mobile recommends researching the make of engine and engine temperature management technologies utilized by the engine manufacturer.

For more information on the engine in your Generac Mobile diesel generator, consult your owner's manual at www.generacmobileproducts.com/manuals.

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