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Running in your Diesel Generator

This information is provided to assist readers in understanding the importance of correctly running in a diesel generator and what happens or can happen during the first few hundred hours of operating your generator.

All engines but particularly diesels require some kind of running-in period. Engine manufacturing does not achieve the fit that running in can achieve. Running in is a term used to describe the allowing of the cylinder and piston ring surfaces to bed into to each other when the engine is running. Bedding these two surfaces in is the aim of a correct run-in. Bedding in these two specific parts will produce a very tight union in each cylinder. A tight union is very important because it minimises the escape of unburned fuel and pressurized gasses into the crankcase while further minimising crankcase oil from entering the cylinder above the top compression ring.

During run-in, a minimal amount of compression blow-by oil-fuel dilution and oil consumption will be experienced. This is perfectly normal in new engines. However it is imperative that these attributes be as close to nil as possible after running in is complete. Blow-by is the main reason the piston ring and cylinder wall need to fit together tightly. Diesel fuel is introduced into an air environment that is under extreme pressure in order for it to burn without an ignition source. When the fuel burns, the gasses produced multiply the compression pressure in the cylinder. Pressurized gasses that escape by means of the compression ring / cylinder wall interface are called blow-by gases. Pressure that escapes the cylinder in this manner results in a loss of energy. Whether it is pressure lost on compression or combustion, it is unable to be utilized to drive the piston through the power stroke. This loss ultimately results in a reduction of fuel economy and power.

The reasons that running in can take up to a few hundred hours can be generally attributed to engineering targets as well as the function of diesel combustion. Engine manufacturers produce diesel engines to sustain high torque loads over constant and extended intervals.

In order for running in to be achieved reasonable amounts of heat friction and wear will take place before the compression rings will bed in with the cylinder walls. When the piston rings and cylinder walls are new a modest amount of heat is created just from the friction of the new piston rings passing over the new cylinder wall surface. While friction heat is significant the real heat is born from the combustion of fuel in the cylinder. When the fuel is burned gasses are produced that expand and heat all of the cylinder parts. If enough fuel is introduced the resulting combustion can create gasses that expand so much they will actually expand the cylinder wall and the compression rings. It is important to understand

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this because expanding these parts places additional pressure on them which creates more friction and correspondingly more heat. This does not take into account the additional heat from combustion that will be added to the heat from friction. Heat is important to assist wear for running in but too much can cause major problems. This is the reason we should not subject the engine to significant loading for the first few hundred hours of operation. Loading heavily will introduce more fuel into the cylinder and will add significant amounts of heat and pressure to the cylinder components. Couple that scenario with new rings on a freshly honed cylinder wall and we can only imagine the amount of friction and heat being produced and absorbed by the rings. The engine oil lubricating the cylinder walls will flash burn when it contacts the hot piston rings. The burned oil will leave a hard enamel like residue on the cylinder wall commonly known as oil glazing. When the rings are allowed to operate under extreme temperatures oil glazing of the cylinder can happen very quickly. Once this glaze builds up the only repair is costly and requires disassembling the engine and re-honing the effected cylinders. Oil glazing does not occur evenly in the cylinder and the spaces that exist between the ring and cylinder wall are either still there or new larger ones are created. Oil glazing is typically thicker towards the top of the cylinder and it builds up in the areas where heating is the greatest. The glaze has very smooth and friction free properties that do not allow it to be scraped away by the rings. This inhibits further metal-to-metal wear between the cylinder wall and rings preventing further bedding of piston ring and cylinder. The small gaps between the piston ring and cylinder surface will never seal. These spaces will then allow pressurized gasses and unburned fuel to escape into the crankcase while allowing oil from the crankcase to enter the cylinder above the top compression ring.

Running the engine at idle or under no load can create a similar condition to glazing. The piston rings need to expand slightly during this initial running in period just not so much that they overheat and flash the engine oil. The engine needs to be moderately loaded in order to run in correctly. Running the engine under very light or no load prevents the oil film placed on the cylinder wall from being scraped away by the expanding compression rings. The rings will instead pass over the deposited oil film allowing it to be exposed to the cylinder combustion. The oil film will then partially burn on the cylinder leaving a residue that will build up and oxidize over time. Eventually this leaves a hard deposit on the cylinder wall that is very similar to the glaze left from flash burning. Expect oil consumption forever due to oil glazing. The rings never really seat well if they cannot expand from the dynamics and heat that a load produces. Expect poor economy due to the passing of compression and combustion gasses around the compression rings. Also expect to see increased bearing wear and engine wear due to the fuel passing the rings diluting the engine oil.

Heavy loading and light loading can cause some major problems. Moderate loading is the way to correctly run in for the first 200-300 hours. It permits the loose fitting piston rings to expand into the cylinder walls allowing them to perform as intended scraping oil off the cylinder wall and to create friction that will promote wearing the two surfaces to each other's proportions. Moderate loading will permit the piston rings to get hot but not to the point where it will flash the lubricating oil supplied to the cylinder walls.

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Once the rings and cylinder have bedded in they will have worn away a considerable amount of their roughness. They will wear slower than they did when they were new. This reduced wear rate indicates the end of running in and a decrease in oil consumption should be apparent. Blow-by and fuel dilution should also be reduced but may not be as evident. Eventually the cylinder wall wears to the shape of the ring and subsequent cylinder wear evolves to a polishing process. This extended process drastically improves the sealing potential of the cylinder that will correspondingly reduce blow-by and the amount of physical wear on these components.

In summary the best way to run in your diesel generator

- **DO NOT** run the engine hard for the first 200-300 hours.
- **DO NOT** let the engine idle for more than five (5) minutes at any one time during the first 200-300 hours. Remember those loose fitting rings, and possible fuel-oil dilution that were noted above? (Fuel Dilution is very common when diesels idle even with well broken-in engines.) If that fuel is allowed to contact the main and rod bearings during run in (not really good at any time) you may have an engine that will always consume some oil and one that may not produce power or economy as expected. In the first few hours of running in the bearings are bedded into the crank rods etc. It is imperative during this time that the lubrication qualities of the oil remain robust. Fuel in the oil will reduce its ability to absorb shock and float the rotating parts in their bearings. Contact between bearings and journals will occur more frequently which will result in additional friction wear. This will ultimately reduce the tight tolerances between the bearings and journals. What was originally a tight fit will be sloppy and will never be able to bed properly.
- **DO** put a load on the engine at around 300 hours and get the thing hot! Diesels are designed to work and in many cases they operate best under a load. We know that Engine Manufacturers have built today's diesel engines using state of the art technology. They have fashioned parts to match in near perfect fashion. We can now understand that running in is important if you wish to minimise the possibility of your generator being poorly efficient with sloppy fitting parts and oil consumption problems. Following the guidelines and warnings set forth in this article will provide anyone who desires maximum efficiency and power out of his engine many hours of trouble free operation.

This information was sourced from an article written by *Jay Chlebowski Ford Diesel* and relevant parts of that article form the basis of information provided herein.

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