NEW STANDARD FOR DIESEL UNDER NEGOTIATION

by Nicola Mawson

At von Wielligh, retired senior lecturer in mechanical and aeronautical engineering at the University of Pretoria, says new-technology engines are like racehorses that require special feed and regular veterinary care. Older engines meanwhile are like carthorses that can eat any feed. Ultimately though, it is the quality of the "feed" that determines the damage to diesel engines, which include score marks on pistons, heat damage to engines and contaminated fuel, which causes further damage.

As an example, Von Wielligh points out a piston from a front-end loader that failed in an hour while still on the test bench. Other pistons in his office, which is littered with failed engine parts, have holes burnt through them, or are melted away completely.

In a recently presented paper, based on case studies, Von Wielligh cites lubricity levels and contamination as two significant causes of engine failure. "A large number of engine failures have recently occurred on these modern diesel engines; these can be directly blamed on the quality of the fuel used. "Because of poor lubricity of the fuel, as well as some particle contamination, injectors failed prematurely, leading to poor combustion and subsequent damage to the engine.

"Several failures were investigated and eventually tests were conducted on the lubricity and particle contamination of the fuels used in these engines. The tests proved that injector failures occur and engine failure follows whenever the lubricity of the fuel is lower than an accepted norm.

"Several cases were also studied in which particle contamination of the fuel occurred and this, in turn led to injector failure and subsequent engine damage," he says. Melted pistons, as well as score-marks on the side of the piston are caused by needle dribble and poor spray pattern, as the damaged needle gets sticky. This results in the fuel burning directly on the piston. The reason the fuel burns the piston is because the temperature of the compression above the piston is 1500°C, while aluminium melts at 560°C.

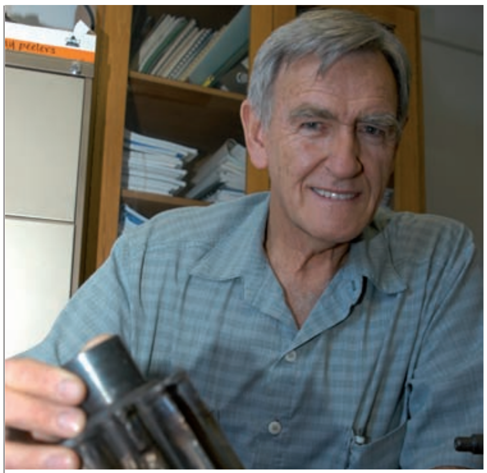
Usually this is not a problem as stagnant air above the piston protects the piston, but fuel dripping from the jet erodes this air. Once the protective layer of air has been eroded, the piston starts to melt. The lubricity level of fuel can be measured by a high-Frequency linear oscillatory Friction and wear test machine in the tribology laboratory of the department of chemical engineering, says Von Wielligh.

Another method of testing is by using the high frequency reciprocating rig (HFRR). "If the lubricity of the fuel is above 700 newton on the SRV, then there is no problem and the fuel is a good enough lubricant." Anything below that figure will inevitably cause injector failure, he says. Where the droplets from a spray pattern are bigger than the fine mist they should be, the fuel does not burn completely. The droplets then reach the cylinder liner and have the ability to thin out the lubrication film on the liner. "This usually results in dilution of the oil film and subsequent dilution of the lubrication oil in the crankcase. Because the lubricating oil dilutes in the crankcase, the viscosity drops substantially and the oil loses its ability to carry the heavy loads of the engine," says Von Wielligh.

The end result is bearing failure (usually the big-end bearings) as well as rapid wear of piston rings. "Several cases were investigated where the wear pattern on the ring almost resembled the same situation as when dust was inhaled by the engine," he says.

Currently, there are no specifications for lubricity in the South African Bureau of Standards' (SABS) SANS 342 specifications for diesel fuel. In addition, the only specification on contamination is that the fuel must be visibly clean; and the human eye can typically see down to 40 micrometers.

Yet Von Wielligh points out that dust particles than can pass through a two-micrometer filter can damage the injection parts of a diesel engine. The present standard is therefore not strict enough. All of this is currently under negotiation at the SABS, and more stringent specifications will hopefully soon be agreed upon, says Von Wielligh. The SABS specifications are likely to specify an HFRR to determine the level of lubricity. This machine



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works on the same principle as the SRV machine except that it runs with a constant load and it measures over a two-hour period. Unfortunately, there are only two of these almost R1-million machines available in the country. Also stricter specifications do not necessary mean that all fuel will immediately meet these requirements, as they are 'agreed upon' specifications. Essentially, consumers will only have recourse in a court of law on a contractual basis if the specifications are not met. This is why several big companies now go out on tender on the basis of fuel quality, forcing suppliers to ensure that the supply chain is faultless says Von Wielligh.

This is where most of the contamination problems arise. Unscrupulous dealers also sometimes add paraffin to diesel, earning themselves an extra R1 profit per litre and doing irreparable damage to engines. The paraffin lowers the lubricity level, as determined by the SRV machine, often resulting in injector and engine failure. "It is a question of policing, but policing the supply chain is difficult." Policing a chain with as many links as the fuel supply chain is a complex task. "It is accepted that fuel leaves the refineries within acceptable quality specifications, but dilution with other fuels occurs and particle contamination is picked up along the supply chain."

The solution is good housekeeping, ensuring stricter standards are adhered to and the tender process for fuel procurement by bigger companies continues.