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Oil Thickening in Light Duty Diesel Engines

Oil thickening and sludge formation have become familiar occurrences in light duty diesel engines. Typically, the offending engines are fitted in 4WD vehicles being used for stop-start city driving or high speed-low load highway cruising. The deterioration of the oil is not due to faulty oil, but is the result of engine design, injection system design and operating conditions which include mechanical and chemical attack. Oil thickening and sludge formation are the results of a complex interaction of components which include: carbon, soot, heat, fuel, water, acids, dirt and engine coolant.

It usually takes about 15 minutes of operation before an engine reaches operating temperature. Diesel engines are designed to achieve combustion efficiency at operating temperature. Until the engine reaches operating temperature, it will experience inefficient combustion, which results in excessive quantities of unburnt or partially burnt fuel and combustion by-products eg. carbon and soot, in the combustion chamber. The unburt fuel makes it way to the oil pan in one form or another, often causing other component damage on the way. Dispersants in the engine oil do their job in trapping the carbon and soot in suspension, neutralizing combustion acids and reducing varnish deposits. However, all of these products are accumulative in the oil. The fuel is chemically unstable and it reacts with itself and the oil to form gums, varnishes and asphaltic type compounds - all of which cause oil thickening. The carbon and soot thicken the oil by a process called 'soot loading'. The acids (sulphuric, hydrochloric and organic) attack the oil and ultimately reduce the detergents, react with unburt fuels to promote sludge and varnish and can cause additive settling or dropout.

Short trips (dropping the kids to school or a quick visit to the corner store), frequent stop-starts (typical of city driving), short trips (short distance to work) and prolonged idling (city driving or specific vehicle applications) increase the moisture contamination of the oil. Air warmed in the engine and blow-by exhaust gases both contain water condensation. If the engine does not operate at sufficiently high temperatures, this condensation is not evaporated off and becomes emulsified in the oil. This again causes oil thickening.

Most small diesel engines do not perform as well as their petrol counterparts, consequently, when driven as town and traffic cars, tend to be driven hard. This usually results in overfuelling of the engine and further oil contamination. The effects of this fuel on the oil has already been discussed. However, it should be noted that while the combustion by-products from a petrol engine are volatile and are driven off when the engine runs at operating temperature for a period of time, this is not the case with diesel fuel. Diesel fuel and combustion by-products are far less volatile and cannot be driven off at operating temperatures and as such, are totally accumulative.

All of the above results in thick and/or sludgy engine oil and sometimes unexpectedly and prematurely. This leads to difficulty in oil flow through the engine, which in turn results in engine component wear and finally complete engine failure. There are several ways of reducing the occurrence of these problems:

- Use only good quality and the right specification engine oil.
- Ensure the engine does not run cold - check the correct thermostat is fitted and operating correctly.
- Replace oil and filter every 5,000 kilometres. On specific models and applications this can be reduced to as low as 3,000 kilometres.
- Ensure the injection pump and pump timing are set correctly.
- Ensure the injectors are correctly set and not damaged.
- Drive the vehicle for what it is - a light duty diesel engine in a heavy chassis, not as a high-revving petrol engine in a lightweight sedan chassis.