TECHNICAL BULLETIN

EGR Systems and Engine Oils

Issue: November 2014

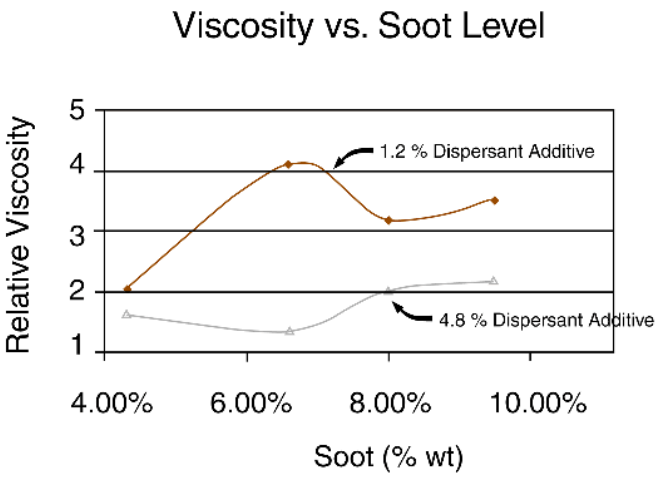
In recent years, engine manufacturers have been required to reduce the levels of nitrogen oxides (NOx) in diesel engine exhaust to meet Tier 3 and higher emission standards required by Governments and Environmental Protection Agencies. One of the reasons for this is because NOx gasses released by the exhaust, have been associated with respiratory disease and cancer. This requirement is accomplished by changes in engine designs that include retarded timing, raised piston rings, selective catalytic reduction and the use of **Exhaust Gas Recirculating** (EGR).

Engine manufacturers use EGR to control NOx emissions by recirculating exhaust gases back into the combustion chamber to be burned a second time, thereby reducing emissions associated with health risks. The amount of exhaust gas introduced into the combustion chamber will displace oxygen, creating cooler combustion. In doing this, many of the exhaust contaminants end up in the engine oil.

Diesel engine oils are exposed to a high level of contamination that can degrade the oil and damage engine parts. Exhaust gas recirculation can have a detrimental effect on engine durability and its effects on the oil. Oils exposed to the EGR environment show an increase in soot content, acid number and viscosity, while the engine and oil are both exposed to corrosive/acidic gases and particle build up.

Cooled EGR occurs when the engine coolant absorbs exhaust gas heat before entering the combustion chamber. Because the engine coolant takes up the heat from exhaust gases, the engine cooling system runs hotter, therefore the oil gets hotter. Oil oxidation rate doubles with every 18^0 Fahrenheit (4^0 Celsius) increase. Oil sump temperatures can also be increased.

In addition to the stress that higher temperatures put on the engine oil, exhaust gases can act as a catalyst for oxidation and nitration in the oil. An improperly operating EGR system can severely aggravate this problem. Waste gate components in an EGR system can be particularly susceptible to surface scuffing damage. If an exhaust gas recirculating system is not operating properly, the engine oil can rapidly deteriorate. Sometimes going so far as to turning the oil into an oxidized, acidic sludge. The catalysing effects of the contaminants introduced into the engine and its lubricant make the oil much more prone to oxidation, nitration and sulphation.



Production of sulphuric acid due to current sulphur levels in diesel fuel and nitric acid from NOx compounds that are recirculated back into the engine through the EGR require engine oils with a higher base number (TBN) and detergency to counter-act the damaging effects of these acidic contaminants. Diesel engines using EGR systems will also require a higher level of dispersancy because of increased soot loading in the oil. Without increased dispersancy, the higher levels of soot and particulate matter will not stay in suspension, increasing wear to cylinder sleeves, rings and valve train components.

Engine oil manufacturers have formulated oils to protect against effects of the EGR environment so that they can provide the required protection that current engine designs need. This has led to API (American Petroleum Institute) CI-4/CJ-4 oil ratings.

These changes in diesel engine design, which include EGR systems, are pushing the performance requirements of diesel engine oil. Older soot limits of 1.5 percent were normal in most heavy-duty diesel engines. Soot limits of three percent are now generally accepted, and higher levels are expected in the future. Soot levels are definitely expected to increase well beyond the nominally accepted level of three percent.

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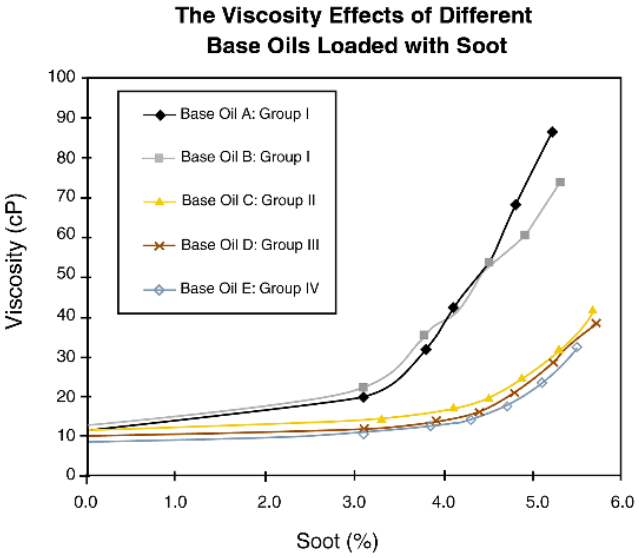
Oil change intervals will be proven by the lubricant's ability to handle the added stress by maintaining an acceptable level of alkalinity reserve (base number), proper viscosity limits through dispersancy and antioxidants and wear control.



Penrite manufacture a range of diesel engine oils with the latest specification technology designed to protect engines against the harshest of environments. Penrite diesel engine oils are available for passenger cars, 4WD's, light & heavy duty commercial vehicles, construction, mining, agriculture, marine and stationary engines to suit pre- EGR through to the latest low SAPS, cooled EGR and selective catalyst reduction engines and systems.

Penrite recommend the "Right oil for the right application". Please visit the Penrite Lube Guide to find the right oil for each application.

Further details on these products are available on their respective product information sheets found on the Penrite web site: **www.penriteoil.com.au/products** or by using your QR Scanner on your smart phone.

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