POLARIS™ Laboratories

Optimizing Drain Intervals Using TBN vs. TAN

TECHNICAL BULLETIN

Safely extending oil drain intervals by using fluid analysis to monitor oil condition and engine wear has always been a significant means for reducing a maintenance department's consumable costs. But in today's economic environment, it is becoming even more critical to achieve optimal drain intervals and, at the same time, minimize engine damage.

Advanced oil formulations have allowed the industry to make great strides in extending drains. The CI-4 and CI-4 Plus oils used in diesel engines manufactured prior to 2007 had a significant impact. Although many felt this progress would be jeopardized by the CJ-4 oils that were later introduced with a lower starting TBN, better CJ-4 additive technology actually enabled many fleets to increase drain intervals even further.

While fluid analysis is the best way to safely determine an optimal drain interval, the appropriate testing should be done by a reputable laboratory that uses reliable testing methods and produces quality results you can trust. Laboratories that are ISO 17025 accredited are required to prove the accuracy of their results on an on-going basis or risk losing their accreditation.

Safely extending diesel engine drain intervals requires the following tests:

- Elemental Analysis
- Wear Metals
- Contaminant metals
- Additive metals
- Fuel Dilution % by Gas Chromatography
- Soot % by FTIR (Infrared Analysis)
- Viscosity @ 100° C (ASTM D-445)
- Water by Crackle
- TBN ASTM D-4739
- Oxidation/Nitration by FTIR (Infrared Analysis)

In the past, standard practices for determining optimal drain intervals using fluid analysis have required testing the oil for TBN **and** TAN. The theory was that when new, an oil's TBN is high and its TAN is low and the longer the oil is used, TBN decreases while TAN increases. At the point at which they meet is the optimal time to change the oil. It is important to note that ASTM D-4739 should be used when testing the TBN of used (in-service) oils as opposed to ASTM D-2896, which may be used when testing TBN in new oils. ASTM D-4739 uses a weaker acid for titration than does ASTM D-2896 and therefore produces slightly lower TBN results.

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Historical test data shows the relationship between TBN and TAN to be quite consistent. TAN just begins to increase when TBN depletion reaches 50%. As the TBN drops below 50%, TAN begins increasing rapidly, so in reality, TBN depletion can reach about 65% before it becomes necessary to change the oil.

Consider a CJ-4 engine oil with a starting TBN of 9.0. TAN will hold steady at around 1.75 to 2.0 until TBN depletes to around 5.5, at which point TAN begins to increase. The two will meet at around 3.15 – 3.5. As a result, most laboratories do not require both a TAN and a TBN to make extended drain recommendations.

The following table represents TBN/TAN test results across a fleet of more than 450 pick-up/delivery trucks. TAN remains fairly steady until the TBN depletes from 12 to about 6. The two meet at between 50 and 65% depletion of the TBN. The TAN is significantly higher than the TBN after the TBN has reached 65% depletion, which indicates that the oil's ability to neutralize acids has dropped significantly. The oil should be changed to prevent corrosive engine wear from occurring.

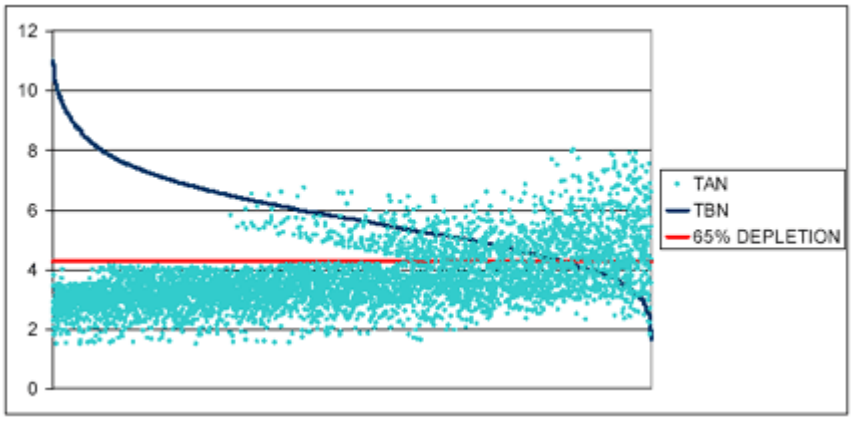

Table 1 - Determining Optimal Drain Intervals Using Total Acid Number

Monitoring TBN, Viscosity, Oxidation and Nitration simultaneously and changing both the oil and filters when contamination from dirt, coolant, fuel dilution or soot reaches critical alarm limits is ultimately the best way to determine optimal engine oil drain intervals regardless of the time on the oil.

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