TSB: OA-2007-05-15

Technical Service Bulletin

Date: 05/15/2007

Product Description: Oil Analyzers Inc. Lubricant Testing

Subject: Condemning Limits for Water Contamination in Engine Oils

OBJECTIVE:

Provide information regarding the importance of monitoring water contamination levels within engine lubricants and define water intrusion warning and condemning limits.

ISSUES:

Conflicting information currently exists with regard to water intrusion limits within engine lubricants. This leads to inconsistent recommendations and the potential of water contamination going unchecked resulting in engine damage or unnecessary consumer costs due to premature oil changes.

TECHNICAL DISCUSSION:

Water contamination in engine oil can be caused by condensation which is more prevalent in continental climates where temperature extremes cause increased condensation and water formation in the engine block cavity. Water contamination can also be caused by radiator or transmission cooler leaks, defective seals, blown or cracked gaskets, or intrusion from an outside source.

Water contamination within engine oil is a primary cause of lubricant breakdown. It causes chemical breakdown of base oils and additives, corrodes component surfaces, and accelerates wear due to reduced lubricant film strength.

Glycol and other additives found in common anti-freeze packages thicken the oil and enhance sludge formation in addition to reducing lubricity. As a result, water intrusion via anti-freeze causes significant issues and engine damage and should be addressed immediately through changing the oil and removing the source of the anti-freeze leak.

RECOMMENDATION:

Based on analysis of the extensive database developed through Oil Analyzers Inc., the following water contamination limits were developed. These warning and condemning limits were also compared with OEM recommendations, several lubricant testing facilities, and experts in the industry for consistency. **The final recommendations are for normal operating conditions and are listed below:**

- **NORMAL (ACCEPTABLE)**
  < 0.05%
- **ABNORMAL (CAUTION)**
  > 0.05% and <0.15%
- **EXCESSIVE (CRITICAL)**
  ≥ 0.15%

Exception: If water levels reach the abnormal range through severe service or through driving in winter (extreme temperature swings), this constitutes a special cause. If the abnormal levels can be linked to a temporary special cause and adequately understood, the lubricant can be continued in service. If the level remains elevated for no known reason, consult an expert for analysis.

Important Note

If ***ANY*** antifreeze is detected, the source of contamination should be corrected and oil should be changed **regardless** of water contamination level.

Submitted By: EK **Reviewed By: DP** **Approval By: COO** **Date: June 28, 2007**

Distribution: ___Internal ___All

TYPES OF WATER DETECTION TESTS

There are several tests used to determine water content in engine oils. Three common methods are the visual FTIR spectrum match, crackle test, and Karl Fisher Coulometric Titration test (ASTM D 6304). The Karl Fisher produces the most accurate information and is commonly run after a positive finding by either the FTIR spectrum match or crackle test.

1. FTIR Spectrum Match

This test is performed through computer analysis of the oil sample and requires a trained operator to interpret the results.

2. Visual Crackle Test (see figure A)

The visual crackle test provides a simple field or laboratory method to detect and ***roughly*** quantify the presence of water in engine lubricants. The test is a simple way to identify the presence of free and emulsified water in a suspended oil. This water can destroy both lubricating oil and equipment.

Test Methodology:

a. Set-up a hot plate at a temperature of 300 degrees F (135 degrees C). Make sure to test the sample at the prescribed temperature level each time.

b. Shake the oil sample vigorously to achieve a homogenous suspension of water in oil.

c. Using a clean dropper, place one drop of oil on the hot plate.

d. If there is water in the oil sample, the response will occur immediately. The degree of the bubbling is directly proportional to the amount of water in the oil sample. Refer to Figure A in the right hand column to approximate the amount of water present.

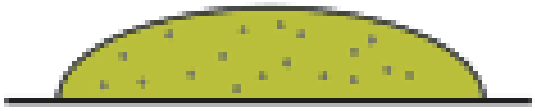
3. Karl Fischer Coulometric Titration (ASTM D 6304)

A positive Crackle test will prompt the laboratory to run the Karl Fischer Coulometric Titration Test (ASTM D 6304) for a more accurate assessment of total water content. If the Crackle test indicates low levels of water, ASTM D 6304 is a much more accurate method of determining the actual amount of water in engine oil. The Coulometric method is used for moisture levels in the range of 10 micrograms to 10 milligrams of water i.e. "low level water".

FIGURE A

1. If no crackling or vapor bubbles are produced after a few seconds, no free or emulsified water is present.

2. If very small bubbles (0.5 mm) are produced but disappear quickly; approximately 0.05-0.1% water is present.



3. If bubbles that are approximately 2 mm in diameter form, gather to center of oil spot, enlarge to about 4 mm, then disappear, then approximately 0.1 to 0.2% water is present.