



Technical Service Bulletin

Date: 5/15/07

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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, leading to inconsistent recommendations and the potential for water contamination going unchecked and 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 increase 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, causing chemical breakdown of base oils and additives, component surface corrosion and accelerated wear due to reduced lubricant film strength.

Glycol and other additives found in common antifreeze packages thicken oil, enhance sludge formation and reduce lubricity. Water intrusion via antifreeze can lead to engine damage and should be addressed immediately by changing the oil and removing the source of the antifreeze leak.

RECOMMENDATION:

The following water contamination limits were developed based on the extensive database developed through Oil Analyzers Inc. To establish consistency, these warning and condemning limits were also compared with OEM recommendations, several lubricant testing facilities and experts in the industry. The final recommendations are

for normal operating conditions:

- NORMAL (ACCEPTABLE)
< 0.20%
- ABNORMAL (CAUTION)
≥ 0.20% and < 0.50%
- EXCESSIVE (CRITICAL)
≥ 0.50%

Exception: If water levels reach the abnormal range through severe service or winter driving (extreme temperature swings), it constitutes a special cause. If the abnormal levels can be linked to a temporary special cause that is adequately understood, the lubricant can continue in service. If the level remains elevated for an unknown reason, consult an expert for analysis.

Important Note

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

Submitted By: EK

Reviewed By: DP

Approved By: AA

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Distribution: Internal

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TYPES OF WATER DETECTION TESTS:

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

1. FTIR Spectrum Match

The FTIR Spectrum Match 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.

Test Methodology:

- a. Set-up a hot plate at a temperature of 300°F (135°C). Be sure to test the sample at the prescribed temperature level each time.
- b. Shake the oil sample vigorously to achieve a homogeneous 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 bubbling is directly proportional to the amount of water in the oil sample. Refer to Figure A in the right column to approximate the amount of water present.

3. Karl Fischer Coulometric Titration (ASTM D 6304)

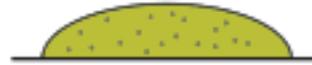
A positive FTIR spectrum match or visual crackle test will prompt the laboratory to conduct the Karl Fischer Coulometric Titration Test (ASTM D 6304) for a more accurate assessment of total water content. The Coulometric method is used for moisture levels in the range of 10 micrograms to 10 milligrams (i.e. "low level water").

FIGURE A

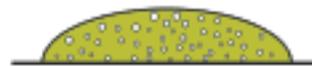
1. If no crackling or vapor bubbles are produced after a few seconds, no free or emulsified water is present.



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, approximately 0.1 - 0.2% water is present.



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