

# Acid and Base Number Testing

What to know about testing the Acid and Base Levels in your oil

## Base Number Testing

We have two ASTM Base Number analysis testing methods: D2896 and D4739. D2896 measures the Total Base and includes **all sources** of Base Number including detergent, dispersant, antiwear and antioxidant additives. On the other hand, D4739 measures the 'hard base' such as that from over-based detergents. In addition to ASTM D2896, the Total Base Number of a lubricant can be tested by the procedure detailed in ASTM D4739. There are subtle, yet important differences to consider when looking at Total Base Number data from each. A third method is a modified method of D2896 by Dexil that prepackages the titration and reagents into a field kit

**D2896 vs D4739** In addition to ASTM D2896, the Total Base Number of a lubricant can be tested by the procedure detailed in ASTM D4739. There are subtle, yet important differences to consider when looking at Total Base Number data from each. Technically speaking, the primary differences between D4739 and D2896 are D4739 uses hydrochloric acid as the titrant and D2896 uses perchloric acid. In addition, they use different titration solvents.

**ASTM Definitions** Because hydrochloric acid is weaker than perchloric acid, D4739 is less effective than D2896 in titrating weak bases. This can result in what ASTM refers to as a "falsely exaggerated" or sometimes even "falsely understated". For these reasons, ASTM says: When the base number of the new oil is required as an expression of its manufactured quality, Test Method D2896 is preferred, since it is known to titrate weak bases that this test method may or may not titrate reliably.

**ASTM Recommendations - New Oils** When the base number of a new oil is required as an expression of its manufactured quality, the test method D2896 is preferred, since it is known to titrate weak bases that this test method may or may not titrate.

**ASTM Recommendations - Used Oils** When the base number of in-service or at-term oil is required, D4739 is preferred in many cases, specifically for internal combustion engine oils, weakly basic degradation products are possible. Test method D2896 will titrate these, thus giving false value of essential basicity. When a loss of a base number value as an oil proceeds in service is required, then test method D4739 should be used.

## Acid Number Testing

Currently in North America, the term total acid number (TAN) is being replaced with acid number (AN). This change is based on the fact that AN tests do not detect the total acid concentration of the lubricant. The acid concentration of the lubricant contains both strong and weak components. Strong acidic components are referred to as SAN.

The weak components and the strong components are typically combined as AN. Even though AN is comprised of both acidic components, it does not represent all acidic components in the lubricant. This is the reason that TAN is being replaced by AN.

**ATSM D664** Measures acidic constituents by using a potentiometer to determine an end point. This method can be used to measure both **AN and SAN** present in sample. To prepare the sample a mixture of toluene, isopropyl alcohol and water is dissolved into a sample. Potassium hydroxide is then titrated into the solution using a burette. The potentiometer output is monitored while the KOH is titrated into the solution. (R1)

**ATSM D974** Measure of acidic constituents using a color change to indicate the inflection. The sample is dissolved into a solution of toluene, p-naphtholbenzne, and isopropyl alcohol containing water. The solution is titrated with KOH while the color is monitored. This test is used on new oils and oils that are not excessively dark. (R1)

**Recommendations - New/Used Oils** The D974 is based on visual representation of a color change to indicate the inflection point and the D664 is using the potentiometric to determine the inflection point of the sample, it is recommended to use D664 method. D664 method also has a higher percentage for reproducibility.

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Referene: (R1) - <https://www.machinerylubrication.com/Read/1052/acid-number-test>