



Application of Acid Number, i-pH, Oxidation Number, Nitration Number in Monitoring Lubricant Service Life



Acid number determination, initial pH (i-pH), oxidation and nitration number are separate but related measurements when testing in service lubricants.

Lubricants, new and used, will contain both weak and strong acids. **Acid numbers** in new oils reflect additives used in the oil formulation. Acid number for new and used lubricants is commonly tested by method ASTM D664, which measures all the acidic species in an oil sample.

Acid number measured for in-service lubricants is generally regarded as a trending tool to monitor aging of a lubricant due to oxidation and degradation. Therefore, acid number is intended to monitor the oxidation progression of an oil sample. A high acid number, though indicating increased oil oxidation, does not necessarily mean the acidic species measured by the test are inherently corrosive.

Oxidation itself is detrimental due to loss of lubricating properties and loss of additive performance. Though the acid number indicates the presence and creation of acidic constituents, it does not indicate their strength. Hence, the measurement of the acid number may not provide a reliable reference in terms of the potential for corrosion of an oil. The acid number of a used oil is flagged when it shows a significant increase over the new oil baseline. This is dependent upon the lubricant formulation and the application.

I-Ph correlates to the corrosion potential of an oil sample by measuring the strength of the strong acid constituents that are corrosive in nature. I-pH is the pH of a prepared used oil sample which is measured initially by ASTM D7946, prior to performing the titration for determination of the acid number by ASTM D664. The i- pH will measure in-service lubricants with a potential to form strong acids, or contamination from strong acids that are corrosive

in nature. Typically, a warning limit for used oils occurs when the initial pH drops to 4.0 and lower, depending on application and reporting requirements.

Though acid number and i-pH have commonly been used in regard to testing in-service lubricants in natural gas equipment applications, more interest is occurring as to relevancy to testing newer formulations for diesel engine oils. This is due to a continued decrease in the relevancy of using base number to monitor used diesel engine oil service life in modern engines using current oil formulations.

One of the challenges with using acid number in some applications is less precision of the test when it comes to used oils. This is where providing oxidation number and **nitration number** has some advantages over acid number in providing more consistent data. Oxidation number and nitration number are both modes of oil oxidation and oil degradation in different forms. Increases in the oxidation and nitration numbers reflect formation of oil degradation constituents within a used oil due to aging and chemical reactions experienced in operating equipment. Some users prefer to use oxidation and nitration to monitor aging and degradation of in-service lubricants as a complement to acid number or in place of acid number. Oxidation and nitration data also correlate well with changes in the i-pH, which combines trending data for aging and degradation with the corrosive potential of the used oil.

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