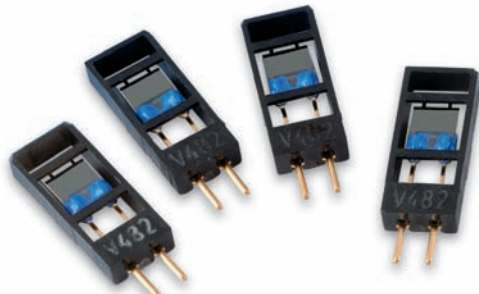


Vaisala HUMICAP® Sensor Measuring Moisture in Oil



Vaisala HUMICAP® Sensor

We in Vaisala have decades of experience on industrial humidity measurements. We have expanded our humidity knowledge to cover also on-line measurement of moisture in oil.

Moisture in Oil

Water is a common contaminant in industrial oils. Water contamination deteriorates the performance of oil, be it used for lubrication, cooling, insulation or other purposes. A high moisture content increases the risk of corrosion, overheating, machine malfunction and other problems. Water contamination can lead to costly failure and unscheduled downtime. Monitoring the oil for moisture is a simple way to improve the reliability of industrial machinery and equipment. With time, substantial savings in maintenance costs can be achieved.

Free water formation - the critical point

Water can dissolve in oil. When the water content reaches the saturation point of that oil, it separates out and free water is formed. The ability of oil to hold water in solution depends on the oil type, its age, and additives present. As the temperature rises, the solubility of water also increases. Free water formation is critical in terms of problems related to water in oil. When water is no longer dissolved in the oil, then corrosion and wearing

of equipment increase rapidly. For this reason, it is important that the moisture content is kept safely below the saturation point.

Water Activity (a_w) - a direct measure of oil quality

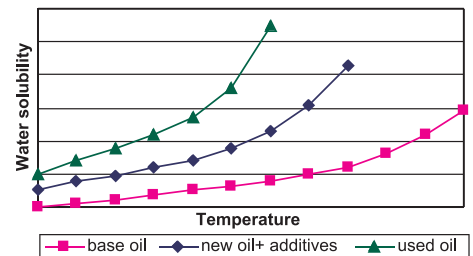
Water activity measurement indicates directly whether there is a risk of free water formation. With a relative scale from 0 (no water present) to 1 (the oil is saturated with water) it gives a reliable indication of how close the saturation point of water is. Water in its free form has a water activity (a_w) of 1.

As the solubility of water in oil increases with rising temperature, the oil's saturation point pulls further away. Thus water activity decreases with rising temperature.

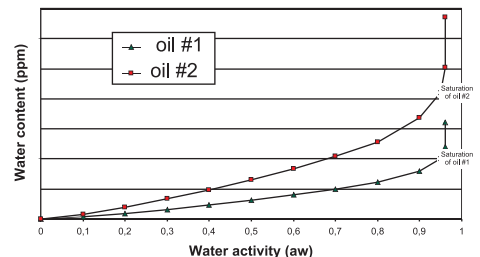
Measurement independent of oil type, age or temperature

In contrast to traditional measurement techniques, water activity measurement is independent of oil type. The measurement remains proportional to the saturation level of water in each individual oil. Water activity measurement is reliable. The reading always indicates the true situation at that moment. In its simplicity, the a_w value is understandable at a glance. Trends can be quickly identified.

More than
10 years!



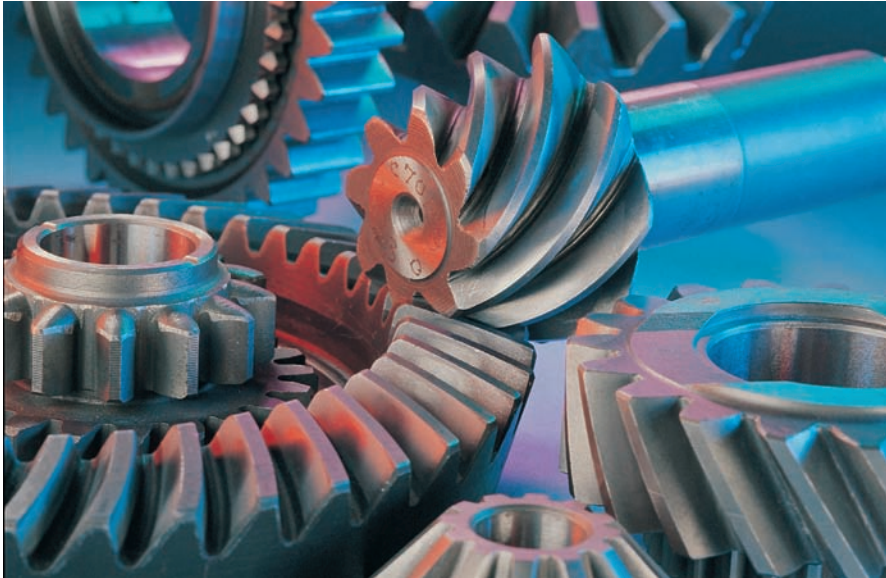
The solubility of water in oil is affected by oil aging and additives (see graph above). The solubility increases with rising temperature.



Water activity measurement is independent of oil type.

On-line measurement

As water activity measurement can be performed on-line, the response is fast. This may be crucial e.g. when detecting leaks through an increase in the water content of oil. The continuous measurement ensures reliable performance of equipment at all times reducing sources of error. Time-consuming sampling and laboratory analysis is not needed. This not only reduces the risk of human error but also provides the customer with a cost-effective measurement and savings in equipment and chemicals.



Water contamination in lubricating oil deteriorates both the lubrication performance and the ability of the oil to protect the machine from corrosion. Careful monitoring of the oil for moisture is essential if costly failures and unscheduled downtime are to be avoided.

Typical applications

Moisture is an important factor determining the condition of both lubricating and transformer oils. With on-line information on the quality of the oil, preventive actions can be taken and the maintenance costs cut substantially.



Fast, reliable and accurate measurement of moisture in oil is needed also in marine applications, such as the circulation lubrication systems of under-water propulsion motors.



By measuring moisture in oil of a paper machine's lubrication system, mills can significantly reduce the maintenance costs and prolong the machine's service life.



Industrial plants like power generation mills have various oil filled systems such as transformers and huge bearings, where oil acts as insulating material, lubricant and/or cooling agent.



The determination of moisture in oil is an essential part of a comprehensive transformer maintenance program.