VAISALA / SUCCESS STORY

DryKeep® Transformer Dehydration System Vanquishes #1 Enemy: Moisture

Vaisala HUMICAP® Moisture and Temperature Transmitter Plays Vital Role

As load demands on aging substation power transformers increase, damage control has become the key strategy for avoiding catastrophe. The loss of energy not only shuts down communities, but the costly replacement of equipment can become an economic burden. While engineers face multiple challenges, moisture is a persistent enemy to the life of a power transformer.

Moisture can take a power transformer offline because it deteriorates the mechanical properties of the paper insulation and the dielectric properties of the insulation system. Even worse, the problem grows exponentially because moisture build-up inside a transformer is an auto-acceleratory process: Moisture is a byproduct of the natural ageing of the insulation; the presence of moisture speeds up insulation degradation; creating even more moisture.

Until fairly recently, utility companies took a reactive approach to this problem. To assess moisture, engineers would take an oil sample and send it to a lab for analysis. If higher than permissible moisture levels were detected, a portable dehydration system would be brought in to dry out the transformer.

Ed Vance, sales manager for DryKeep®, a brand of the Ardry Group, remembers those days.

"The old way of doing things was good for the time because that's all that was available," he says. "But by using reactive strategies they were not necessarily dealing with the actual problem. They were fixing it temporarily with portable units, then allowing the moisture to build-up again. All the while the mechanical properties of the paper continued to deteriorate on an accelerated pace in-between those intermittent, reactionary dry-outs. That deterioration is irreversible."

The DryKeep® System changed all that about 15 years ago. The benefits were so immediate the innovation won praise as the original on-line molecular sieve dry-out system for power transformers.

Vance says the system is effective because it is permanently attached to the transformer and therefore continuously removes moisture while monitoring moisture-in-oil and oil temperature with SCADA Ready SMART* Dehydration Control. Using Vaisala sensors with DryKeep® proprietary algorithms, this proactive system calculates the percentage of moisture in the insulation paper, removes it, and then keeps it dry, proactively stifling the detrimental effects moisture has on cellulose ageing. A 1-micron particle filter also removes loose particles from the transformer oil.

Although the dehydration system is permanently attached to a transformer, operators can control the system and access data remotely, if necessary, from the plug-and-play SMART DryKeep® controller and 7-inch touch-operated color LCD screen (HMI) that displays real-time moisture and temperature values. System alarms can also be programmed and sent remotely through the included SCADA-ready/ cellular RTU.

While the convenient, proactive system is a vast improvement from previous methods of dehydration and monitoring, Vance says its efficiency and reputation have been enhanced by a small component embedded within the system.

Vaisala HUMICAP® Sensor

Vaisala HUMICAP® MMT162 is a capacitive thin-film polymer sensor especially developed for demanding moisture measurements in liquid hydrocarbons. The sensors are permanently installed in the DryKeep® system to determine water content and oil temperatures. By producing real-time data, engineers can keep tabs on moisture levels and oil temperature in the transformer continuously under actual operating conditions.

"The sensor allows us to control the drying process and send real-time and historical data and trend analysis to the operator," says Vance. "And it can all be done without shutting down the transformer."

There are two Vaisala sensors in the dehydration system. The SMART system compares the two values and when they converge, the system notifies the user locally and remotely that the cylinders are saturated. Cylinders can be regenerated for reuse on-site for fast and easy process continuity.

The power transformer remains on-line, energized and under load at all times. There is no down time.

Regardless of regional climate, severe or mild, moisture is a pesky, universal problem. Water can enter via the atmospheric conditions, or seep in during maintenance on the transformer.

Unfortunately, moisture is also a byproduct of the aging of the oil and the insulation. So, even if the equipment is completely sealed from exterior moisture, water build up will still occur.

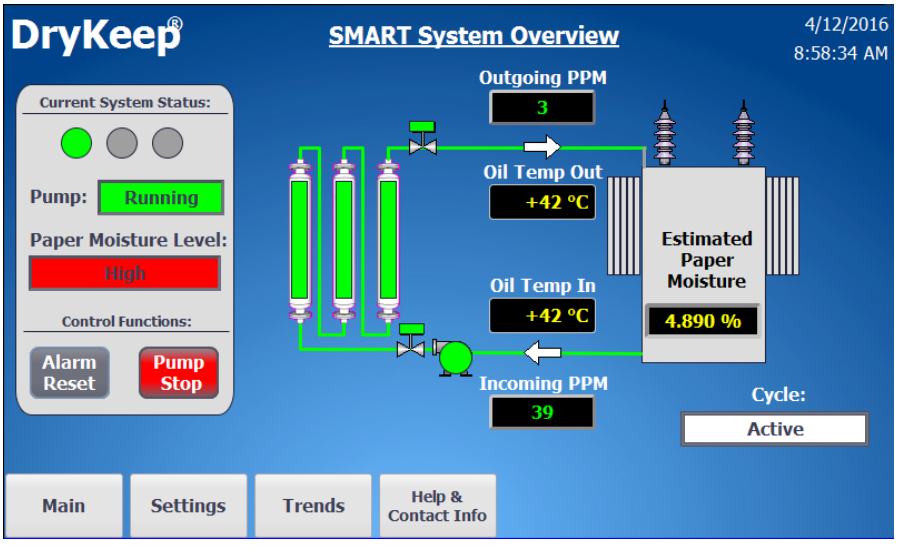
Fortunately, extending the life of a power transformer is much less expensive than buying new equipment, according to Vance. "The DryKeep® on-line dehydration and monitoring system is a small fraction of the sticker price of a transformer."

Avoiding premature overhauls to the energy grid demands close attention to the decline of cellulose insulation. Unlike some components in a power transformer, the cellulose insulation is extremely expensive and cannot be replaced in the field.

Industry studies have proven that if no drying precautions are taken, the average life expectancy of a transformer is about 35 years. By introducing a permanently installed molecular sieve drying system, independent tests indicate that the life of a transformer may be expanded to 60 years—a 25-year gain.

Cutting costs likely appeals to an energy sector that is under intense financial pressure as it faces the challenges of consolidation, stronger competition, declining load growth due to use of renewable sources and budget cuts. Also, the costs for grid modernization are increasing as the workforce and the hard assets—power transformers—are aging.

Therefore, preventative medicine may no longer be a choice but a requirement for survival. Proactive analysis with real-time data, coupled with low maintenance solutions, allows industry giants to defer capital expenditures so they can shape a brave new world.



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