

Case Study: AZEVAP, LLC

Revolutionary AZEVAP AZFlow™ Evaporative Cooler Utilizes Opto 22 Technology

With today's social and political focus on global warming and the need to reduce energy consumption, cooling solutions that utilize evaporative cooling processes have become a popular alternative for industrial facilities and other buildings. But despite the fact that evaporative coolers use as little as 1/8th the power of a traditional cooler or chiller system, adoption of the technology in many industries and settings has been slow due to both real and perceived drawbacks. AZEVAP, LLC, located in Phoenix, Arizona, has developed new methodologies and technologies that address some of these drawbacks which include:

- The ability to achieve cooling objectives as the wet bulb temperature and relative humidity increases
- The high rate of scaling and the associated need for frequent replacement of the media (cooling pad)
- Varying degrees of reliability of the water level control system and resulting flooding and maintenance issues
- Water entrainment and corrosion of cooler components, ductwork, and other parts
- Stagnant water, mold and fungus, and the associated health issues
- Water usage rates



Using cutting-edge technology, AZFlow coolers maintain efficiencies of 85% to 90% after several years of operational service



AZFlow coolers have embedded Opto 22 SNAP-brand control hardware as their central component

The AZEVAP LLC founders have applied their many years of engineering experience in designing process equipment for the industrial sector to design a new suite of coolers with unique features and capabilities. These cutting-edge coolers, which have embedded Opto 22 SNAP-brand control hardware as their central component, address all of the aforementioned limitations, plus others, typical of most coolers. (Several patents have been issued and others are pending for these features and functions.)

At the heart of the AZEVAP technologies is the AZFlow® water distribution and metering system, which calculates and applies just enough water to the media to offset cooling evaporation and achieve desired discharge water cycles of concentration. This is in contrast to recirculating coolers, which bathe the media with water pumped from a sump at an average rate more than 2.5 times the evaporation rate. Recirculating the water in this manner

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results in water entrainment issues at lower air velocities and increases in the salinity of the water, which in turn leads to an increase in the rate of media scaling.

Additionally, most coolers using 12" media show cooler performance degrading relatively quickly over just the first few of months of operation—from a high of ~ 80% to less than 70%. AZFlow coolers, by comparison, have demonstrated an ability to operate scale free and to achieve and maintain efficiencies of 85% to 90% after several years of operational service, without changing the media.

Finally, the ability to achieve desired cooling objectives as relative humidity and wet bulb temperatures increase declines sharply as cooler performance efficiency decreases. The high efficiency of the AZFlow coolers allows them to extend their effectiveness in meeting cooling objectives as the wet bulb temperature and relative humidity increase.

The AZFlow cooler was developed through AZEVAP's design of a patented water distribution system that uses an embedded Opto 22 SNAP control system as its central component. The system gathers sensor data, such as surrounding air temperature and humidity, and airflow measurements using Vaisala and Dwyer Instruments-brand sensors that connect to and communicate with the SNAP processor via analog I/O modules residing on a SNAP rack. The system then uses a proprietary algorithm executed by a Linux-based controller to correlate the instantaneous water evaporation and water application rates so the proper volume of water is delivered across the media, ensuring that it never gets too wet or too dry. More specifically, the algorithms determine just how long the cooler's water application valve stays open in order to keep the cooling pad damp.

The aforementioned Linux controller was programmed and implemented by Opto-Solutions, (www.opto-solutions.com) a consulting and integration services company founded by Anthony Dern, a control engineer with more than 20 years experience designing and deploying industrial automation and control applications. A former Senior Technical Advisor at Opto 22, Dern left the company several years ago to form Opto-Solutions. Dern's vast knowledge of the Opto 22 product lines, combined with his C programming ability, allowed him to develop a custom application for AZEVAP's Linux controller to communicate with Opto 22 I/O modules and execute all the cooling-related strategies. (In this way, Opto-Solutions was able to provide an alternative to the PCs and PLCs often used by original equipment manufacturers for I/O control in HVAC-related machines.)



SNAP digital output modules enable a Linux-based controller to regulate the cooler's fans

"I've always believed that the Opto control hardware is the best around. And because it's open and non-proprietary, it was easy for us to use Linux-based tools to create an interface to the Opto I/O," Dern says.

Besides reading the I/O, aggregating all the data, and controlling the valve used to wet the media, the AZEVAP control system also connects to other evaporative cooler components. For instance, an RS-485 serial interface is used to read the amps and horsepower of the variable frequency drives that regulate the cooler's fans. Interfaces to SNAP digital output modules enable the controller to power these fans (along with the entire cooler itself) on and off. Also, within the coolers, SNAP modules connect float switches and valves to the controller to give warning of clogged drains so that any water accumulation can be identified and corrected before damage occurs.

All cooler system control processes and acquired data are visualized using a web-based HMI where system performance is viewed, alarms are established and acknowledged, and fail-safe contingency actions are devised and set.

AZEVAP has deployed its AZFlow coolers within its own facilities and has realized increased operational and energy efficiency, and significant water savings as a result. Additionally, an early version of the AZFlow cooler was installed in 2003 at the famous Bank of America office building in downtown Phoenix. Less than six months later, the savings realized by the bank paid for its AZFlow system many times over.

About Opto 22

Opto 22 develops and manufactures hardware and software for applications involving industrial automation and control, remote monitoring, and data acquisition. Opto 22 products use standard, commercially available networking and computer technologies, and have an established reputation worldwide for simplicity, innovation, quality, and reliability. Opto 22 products are used by automation end-users, OEMs, and information technology and operations personnel. The company was founded in 1974 and is privately held in Temecula, California, USA. Opto 22 products are available through a worldwide network of distributors and system integrators. For more information, contact Opto 22 headquarters at 951-695-3000 or visit www.opto22.com.

About AZEVAP LLC

Founded in 2001 to fill a need for evaporative coolers manufactured as industrial process equipment, AZEVAP's founders and engineers Larry and Don Kammerzell reviewed the history of evaporative cooling and looked at the fundamental problems associated with the process. In

developing the AZFlow cooling technology they combined a number of engineering disciplines to solve the problems that have limited the effectiveness of evaporative cooling. AZEVAP LLC is located in Phoenix, Arizona and is owned and managed by a seasoned group of Professional Engineers with the skills and experience to develop and deploy this breakthrough technology. For more information, contact AZEVAP at 602 243-5121 or visit www.azevap.com.

About OptoSolutions

Opto-Solutions Engineering & Design, Inc. is a leader specializing in providing solutions for many diverse industries such as machine automation, building and energy management, semiconductor, video security and access control, mobile, agriculture, biotechnology using high-level languages such as VB, C or Java with MS Windows or Linux, SQL database or SCADA. The company focuses on integrating off-the-shelf Opto 22 products, but can also create custom hardware packages for unique opportunities. Whether it is wired or wireless Ethernet, cellular, radio or wireless sensors, Opto-Solutions' proven team of specialists can access the problem and provide the answer.