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COOLING SYSTEM OPTIMIZATION

- 10 Flow-The Most Important Factor for Injection Molding Heat Transfer By Al Fosco, Frigel North America
- 14 Deschutes Brewery and Holladay Park Plaza Save with the Energy Trust of Oregon By Rod Smith, Chiller & Cooling Best Practices Magazine



COOLING TOWERS & CHILLERS

- 20 Evaporative Cooling Tower Innovations By Glenn Brenneke, SPX Cooling Technologies
- 24 Modular Cooling Blocks Revolutionize Data Center Energy Usage By Lisa Tryson, Danfoss

COLUMNS

- **4** From the Editor
- 5 Resources for Energy Engineers Chiller & Cooling Tower Technology Picks
- 28 Industrial Cooling System Industry News
- **34** Advertiser Index
- 34 The Marketplace Jobs and Technology



CHILLER & COOLING BEST PRACTICES 0 8 / 1 8

FROM THE EDITOR



Challenge the engineering specification for cooling water supply to the process. This is worth writing three times but people would consider it a typo. Al Fosco, Frigel North America Marketing Manager writes, "An important "rule of thumb" is that the capacity of a chiller is reduced by 2% per °F below 50°F. So, if the temperature is reduced by 5°F to 45°F (from 50°F), the chiller capacity is lowered by 10%." How well do you understand the impact of "turbulent flow" on chiller capacity? Before buving your next chiller, I

highly recommend reading Mr. Fosco's lead article in our issue this month titled, "Flow-The Most Important Factor for Injection Molding Heat Transfer."

I have a somewhat irrational enthusiasm for the work done by utility incentive programs to save energy and water. End users always tell me the presence of the utility expert, as well as the incentive dollars, gave them the confidence to invest in a "energy project." This month we feature an article about two clients of Energy Trust of Oregon, Deschutes Brewery and Holladay Park Plaza, and the chiller projects they did together.

Evaporative cooling towers are a critical part of any cooling water system. The cooling tower manufacturer is several steps away, in the supply chain, from the "owner" of the unit. How do they get market feedback then for new product development? An article provided by R&D Vice President Glenn Brenneke, from the manufacturer of Marley[®] cooling towers and fluid coolers, SPX Cooling Technologies, answers this question for one firm.

According to drive manufacturer, Danfoss, data centers use nearly 2 percent of the world's supply of electricity at any given time, and 37 percent of that amount is used to keep computing equipment cool. Not only is this a drain on the power grid, but it also taxes water supply. A 15-megawatt data center can use up to 360,000 gallons of water a day. Data center power consumption is on the rise, increasing 56 percent worldwide and 36 percent in the U.S. from 2005-2010. Danfoss has provided us an article about their efforts to help data centers reduce water and energy consumption.

The inaugural 2018 Best Practices Expo & Conference, is being held September 17-19, 2018 at the Chicago O'Hare Crowne Plaza. Please consider registering for the event at www.cabpexpo.com.

Thank you for investing your time and efforts into **Chiller & Cooling Best Practices.**

ROD SMITH *Editor tel: 412-980-9901, rod@airbestpractices.com*



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RESOURCES FOR ENERGY ENGINEERS

CHILLER & COOLING TOWER TECHNOLOGY PICKS

Frigel Extends Digital Controls to Microgel RCP Chiller

Frigel has extended its digital control technology to the Microgel RCP Chiller, giving processors in demanding polyethylene terephthalate (PET) preform and large-part blow molding operations the ability to more effectively optimize productivity, profitability and quality.

Uniquely designed to deliver high-pressure and high-flow cooling water for individual processing machines, the Microgel RCP Chiller eliminates the need for central chiller systems in PET preform, large-part blow molding and high-speed multi-cavity injection molding applications. Taking the capabilities of the unit to the next level, the addition of digital controls gives the same users the ability to capture process-cooling energy consumption data and more easily adjust the unit for specific molding conditions for optimal efficiencies and cost savings.

The enhancement to the Microgel RCP Chiller is another example of Frigel's commitment to helping processors leverage process-cooling



The Frigel Microgel RCP Chiller now has digital control technology

innovations to gain a clear-cut advantage, said Frigel North America Marketing Manager Al Fosco.

"The Microgel RCP Chiller is the only machine-side chiller that provides powerful cooling with high coolant pressure and flow throughout the mold, which is essential in PET preform and large-part blow molding applications," Fosco said. "The addition of our digital controls meets another essential need by allowing processors to more readily access process cooling data, including energy data over extended periods. As a result, processors are better able to cost-effectively and efficiently improve cycle times and consistently produce quality products in these demanding cooling applications."

The Microgel RCP Chiller is engineered with a high-efficiency, high flow/pressure process pump, enabling it to provide turbulent flow and low temperature rise across large and multi-cavity molds. The unit also features motorized servo-modulating valves, eliminating sharp temperature peaks and valleys found with traditional on/off solenoid valves. The Microgel RCP Chiller delivers process-cooling water from 7 to 30 °C (45 to 86 °F).

"From ongoing innovations like the Microgel RCP Chiller to the highly scientific approach we take to every customer's operation, Frigel is committed to delivering process cooling solutions that give processors a competitive advantage. It's the Frigel Diamond Service advantage," Fosco said.

About Frigel

Frigel has been a worldwide market leader in intelligent process cooling since the 1960s. Foremost among Frigel's products is Ecodry, a unique, internationally patented, closed-loop intelligent cooling system that has been proven at more than 5,500 manufacturing installations worldwide. Ecodry, an environmentally friendly cooling solution, keeps cooling water clean, delivers substantial savings on water, chemicals, energy and maintenance. Frigel also manufactures and markets the unique, cycletime improving Microgel combination chiller/temperature control units (TCUs), as well as Turbogel and Thermogel TCUs, Aquagel pumping and filtration equipment and Heavygel central chillers. Visit www.frigel.com for more information.

RESOURCES FOR ENERGY ENGINEERS

CHILLER & COOLING TOWER TECHNOLOGY PICKS

Carrier AquaEdge[®] 19DV Centrifugal Chiller Launched in North America

Carrier announced the commercial availability of its AquaEdge[®] 19DV in North America. The centrifugal chiller features breakthrough technologies, Greenspeed[®] intelligence and a low global warming potential (GWP) refrigerant R1233zd(E), which has a GWP of ~1. The AquaEdge 19DV, with installations worldwide, delivers on customer demands for ultimate performance, leading efficiency and environmental responsibility.

Updated innovation in every aspect of chiller design including compression, heat exchange and controls technology enables Carrier to improve cooling efficiency substantially while allowing for effective heat recovery and free cooling all in the same machine.

"Carrier is excited to announce that our AquaEdge 19DV chiller is available in North America. The 19DV represents our unwavering commitment to satisfy our customers' needs through innovative and efficient solutions that deliver optimal comfort with an environmental focus. The 19DV is Carrier's newest model of intelligent HVAC design," said Greg Alcorn, vice president and general manager, Carrier Commercial Systems. "Its simplicity, flexibility and performance make it easy to own and operate."

High operational flexibility to respond to demanding situations

The AquaEdge 19DV has an efficiency that is more than 40 percent higher than ASHRAE[®] 2016 guidelines, has low sound and is capable of series counterflow configurations. Its features include:

- ➢ EquiDrive[™] two-stage back-to-back compressor load cancellation technology for bearings last the life of the chiller.
- Greenspeed[®] intelligence Variable Frequency Drive (VFD) design to protect against dirty power and dirty environments.



Carrier's AquaEdge[®] 19DV centrifugal chiller is now commercially available in North America. It has an efficiency that's more than 40 percent higher than ASHRAE 2016 guidelines, operates with low noise and is capable of series counterflow configurations.

- MaxFlex capability for operation in demanding conditions such as variable flow, heat recovery, free cooling, series plants, dual temperature systems, and more.
- Refrigerant R-1233zd(E), an environmentally sustainable refrigerant with an ultra-low GWP of ~1 and an A1-rated safety classification per ASHRAE standard 34.
- Variable orifice for robust refrigerant metering and proper refrigerant levels during variable lift and load conditions.
 - SmartView[™] intelligent controls and integration with the Carrier lifecycle data management system for easy tracking and analyzation of operational data helps identify potential risks or areas for upgrading. The control system can also be linked to the user's building automation system, enabling remote access to the chiller's running data in real time.
- Intuitive touch screen user interface that provides graphical trending and remote access capability and can be mounted on any corner of the machine.

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A smart connected chiller with Carrier® SMART Service

The 19DV also features Carrier[®] SMART Service, and includes a number of connectivity solutions such as: remote diagnostics, long-term performance trending, benchmarking, decision analytics, and advanced notifications. By leveraging insights derived from these capabilities, Carrier SMART Service can help improve equipment reliability and reduce energy usage, maintenance expenses and resource consumption.

The AquaEdge 19DV is now available for immediate sale in 500 to 800 ton capacity. Additional capacity units are forthcoming. To learn more, contact your local Carrier expert or visit Carrier.com/19DV and follow @Carrier on Twitter.

About Carrier

Founded by the inventor of modern air conditioning, Carrier is a world leader in high-technology heating, air-conditioning and refrigeration solutions. Carrier experts provide sustainable solutions, integrating energy-efficient products, building controls and energy services for residential, commercial, retail, transport and food service customers. Carrier is a part of UTC Climate, Controls & Security, a unit of United Technologies Corp., a leading provider to the aerospace and building systems industries worldwide. For more information, visit www.carrier. com or follow @Carrier on Twitter.

The Marley $^{\scriptscriptstyle \otimes}$ V Tech $^{\scriptscriptstyle \rm M}$ Fluid Cooler Provides Advantages for HVAC Applications

SPX Cooling Technologies, Inc., a full-line, full-service industry leader in the design and manufacture of cooling towers and other specialized heat exchangers, announces the Marley V Tech[™] Adiabatic Fluid Cooler for closed loop HVAC systems. The Marley V Tech Adiabatic Fluid Cooler provides lower energy usage and a smaller footprint than an air-cooled fluid cooler and up to 60 percent or more reduction in site water usage compared to an evaporative fluid cooler. In addition, the V Tech Adiabatic Fluid Cooler's highly-engineered metered water distribution system minimizes water treatment requirements.

The Marley V Tech Fluid Cooler enhances the utility of an air-cooled system with the efficiency boost of a wet system during peak conditions. Adiabatic precooling of the air dramatically increases the heat rejection capability, enabling outlet temperatures not possible with a standard aircooled fluid cooler. Evaporative pads precool air only on peak days and TAE



- Cooling capacity from 1.7 to 57.5 Tons
- High performance hermetic scroll compressors
- Wide operating limits (Twout = 14 °F standard)
- Designed to operate 24/7 under the most demanding industrial conditions
- Innovative evaporator with finned pack and intank configuration, for low pressure drops and reduced sensitivity to impurities
- Eco-friendly refrigerant R410A (ODP=0) ensures high performance thanks its outstanding heat conductivity properties
- Parametric microprocessor controller
- Compact structure
- Suitable for outdoor installation
- Easy installation, use and maintenance



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RESOURCES FOR ENERGY ENGINEERS



The Marley V Tech[™] Adiabatic Fluid Cooler for closed loop HVAC systems

coils remain dry to maintain efficiency and life expectancy. Electronically commutated (EC) motors help ensure reliable and efficient operation.

The Marley V Tech Fluid Cooler is equipped with hydroBLU[™] intelligent water and energy management controls. With adjustable setpoints to tailor operation to the user's needs, the control system determines operating mode, controls fan speed and regulates water volume delivered to adiabatic pads based on real-time conditions, and is suitable for standalone operation or remote interface control.

The integral water management system distributes a targeted volume of water evenly across the evaporative pads, minimizing dry spots. Water not evaporated helps to continuously rinse the pads. This minimizes the potential for scaling and clogging, and reduces accumulation of dirt and debris on the heat exchanger's finned surface. For more information about SPX Cooling Technologies, visit www.spxcooling.com.

*hydroBLU is a registered trademark of Güntner US LLC.

CHILLER & COOLING TOWER TECHNOLOGY PICKS

About SPX Cooling Technologies, Inc.

SPX Cooling Technologies, Inc. is a leading global manufacturer of cooling towers, evaporative fluid coolers, evaporative condensers and air-cooled heat exchangers providing full-service cooling solutions and support to customers in the power generation, petrochemical, industrial, refrigeration, and heating, ventilation and air conditioning (HVAC) markets for 95 years. SPX Cooling Technologies and its product brands are part of SPX Corporation. For more information, please visit www.spxcooling.com.

About SPX Corporation

SPX Corporation is a supplier of highly engineered products and technologies, holding leadership positions in the HVAC, detection and measurement, and engineered solutions markets. Based in Charlotte, North Carolina, SPX Corporation had approximately \$1.4 billion in annual revenue in 2017 and more than 5,000 employees in about 15 countries. SPX Corporation is listed on the New York Stock Exchange under the ticker symbol "SPXC." For more information, please visit www.spx.com.

Armstrong Unveils New Integrated Tower Control System

Armstrong Fluid Technology announced the introduction of the new ITC 9521, an Integrated Tower Control System designed to transform an HVAC installation into an intelligent system for a variety of heat rejection applications.



CHILLER & COOLING TOWER TECHNOLOGY PICKS

"Leveraging Armstrong's advanced demand-based algorithms and industry-leading Parallel Sensorless technology, the ITC 9521 provides users with an energy-efficient solution for heat rejection processes for applications such as datacenters, condensing cooling, heat pumps, paint processing, injection molding and air compressor stations," according to Lex van der Weerd, Armstrong CEO.

Engineered to improve system stability, simplify tower automation and reduce energy costs, the ITC 9521 is fully complementary with other automation systems, providing they use an open front-end for configuration of the heat rejection system and setpoints to another higher-level plant automation.

The ITC 9521 ships pre-programmed and has a user-friendly screen interface that enables easy field configuration. This application can transform an HVAC installation into an intelligent system that provides notifications for remote troubleshooting, on-board diagnostics and support via internet.

Made possible by the highly accurate, real-time flow readings from Armstrong Design Envelope pumps, the ITC 9521 offers configuration and operating simplicity, low installed costs and advanced capabilities for streamlining building operations.

About Armstrong Fluid Technology



The new Armstrong ITC 9521 Integrated Tower Control System

With over 1000 employees worldwide, operating seven manufacturing facilities on three continents, Armstrong Fluid Technology is known around the world as a forerunner and innovator in the design, engineering and manufacturing of intelligent fluid flow equipment. With its expertise in fluid dynamics, heat transfer, variable speed, and demand-based control, Armstrong Fluid Technology leads the fluid systems industry, including HVAC, plumbing, and fire safety in providing the most energy efficient and cost effective solutions to building professionals and owners around the globe.

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COOLING SYSTEM OPTIMIZATION

Flow – The Most Important Factor for INJECTION MOLDING HEAT TRANSFER

By Al Fosco, Marketing Manager, Frigel North America

► A common misconception in plastics injection molding is that coolant temperature is the one true path to achieve productivity and profitability. The reality, however, is that turbulent flow is the primary force behind efficient cooling and a key driver in the ability to achieve operational efficiencies, increase profits and consistently produce high quality products.

Here's what to know about turbulent flow in plastics molding, as well insight into the most recent advances in technology that allow processors to monitor and control flow, in addition to temperature.

Colder is NOT Always Better

Although precise temperature *control* is always critical, don't assume necessarily that lowering the chiller temperature will help to reduce cycle times. Lowering a chiller operating temperature can have many negative effects.

Most chillers are rated (in tons) for 50 °F supply to process, which is just an arbitrary standard that the North America domestic plastics industry has accepted over the years. An important "rule of thumb" is that the capacity of a chiller is reduced by 2% per °F below 50 °F. So, if the temperature is reduced by 5 °F to 45 °F, the chiller *capacity* is lowered by 10%. This can cause the need to increase chiller capacity in order to properly cool the mold. On the other hand, raising the temperature above 50 °F will, likewise, *increase* capacity. For example, increasing the temperature to 65 °F (the typical maximum) will result in an additional 30% capacity. This means more capacity for cooling additional molds using the same chiller.

Another negative effect involves the necessity to use a glycol antifreeze solution, which is typically required for operation at or below ~ 47 °F. This has huge, multiple effects on heat transfer.

As an example, for a chiller to operate at 40 °F, the refrigerant temperature in the evaporator will typically be 30 °F – obviously below the water freezing point. In this case, a 25% ethylene glycol solution will be required (freezing point @ 11 °F), protecting the chiller down to ~20 °F *below* the evaporating temperature. The results are ominous for the heat transfer process and can result in a *vicious* circle.

- Shiller capacity is reduced by 7%.
- Mold cooling capacity is reduced by the same amount.
- Pressure drop (ΔP) is increased by 21%. This means more pumping capacity to achieve the same result. Also, the additional pump motor heat will reduce chiller capacity, *over and above* the reduction due to the lower operating temperature.
- The subsequent result of the above is increased energy cost.

08/18

CHILLER & COOLING BEST PRACTICES

Turbulent Flow IS Always Better

In addition to accurate temperature *control*, optimizing flow through a mold is critical and, quite often, results in decreased cycle times and increased product quality and repeatability, even after *increasing* chilled water temperature. There are three stages of flow – laminar, transient and turbulent. This depends on a dimensionless factor call Reynold's Number, which, for straight pipe, is a function of fluid velocity, internal diameter, fluid density and fluid viscosity ("resistance" to flow). The "flipping" point to turbulent in straight, clean a pipe is defined as 4000, but much higher R values are usually sought for injection molds, considering factors like bubblers, channel geometry, circuiting (i.e. series v. parallel), etc.

Note that viscosity increases when using glycol, resulting in the need for increased velocity to compensate for this increased resistance. This, in turn, requires more pumping to achieve proper velocity, and so on - see *vicious circle* described above.

In laminar mode, a "boundary layer" forms at the pipe (cooling channel) surfaces – literally no flow along the perimeter of the cooling





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FLOW – THE MOST IMPORTANT FACTOR FOR INJECTION MOLDING HEAT TRANSFER

channels. This has the effect of insulation and impedes the heat transfer process. On the other hand, turbulent flow results in no boundary layer and is violent in nature, literally "scrubbing" the heat from the channel surfaces and carrying it away efficiently. Transient is an intermediate range between the two. Here is what the profiles look like:

The target for proper flow and, therefore, heat transfer, should be to limit the water temperature *rise* through the mold (Δ T) to 2 °F or less. This results in even and efficient cooling throughout the mold cavities and consistent part finish and quality, even (and especially) in multi-cavity tools. High turbulent flow is the way to accomplish this and is a function of analyzing the mold requirements, such as cooling load, Δ P, pump pressure required to achieve this low Δ T and, of course, proper pumping selections and the *maximum* chilled water temperature possible.

The results of this optimization of the heat transfer process through proper flow and temperature control are numerous.

- Solution Cycle times and scrap are reduced.
- > Product quality and consistency are improved.
- Energy is reduced due to maximizing the chilled water temperature.
- It's often possible to handle additional molds with the same chiller because of the increased temperature, resulting in increased chiller capacity.

The Path to Optimization

The above-mentioned factors assume a "clean" water system is utilized. Scale can change everything. For example, a 0.3 mm (0.012 inch) scale



thickness on a channel surface will reduce heat transfer by as much as 21%. This can be applied also to any heat exchange surface, including those in a chiller.

As a result, a growing number of processors have turned to closedloop process cooling systems to gain better control of turbulent flow and other process cooling parameters, given the need to increase operational efficiencies and improve margins.

One such system can be described as "decoupled" and involves a closed-loop central dry cooler (as opposed to a conventional open cooling tower) for cooling hydraulic heat exchangers, feed throats, air compressors, etc. and includes a water-cooled combination chiller/ temperature control unit (TCU) located at *each* machine. This system uses heat exchangers and an adiabatic misting chamber to cool water circulated to it from the molding machines and machine-side units.

A decoupled system allows users to gain more control of pressure and flow, because each chiller/TCU is dedicated to a given molding machine. This eliminates problems with insufficient pressures and, therefore, flows at the machines typical of central chilling systems.

At each machine, the chiller/TCU leverages engineered high-flow process pumps to deliver consistent supply pressure and turbulent flow needed for that specific machine and each unique mold, as well as maintaining highly accurate temperature control.

The need for tighter control over pressure and turbulent flow has also driven advancements in chiller/TCU technologies.

Newer combination chiller/TCUs, for example, are equipped with variable frequency drives (VFDs) that allow a unit to develop only the necessary amount of water pressure differential and flow needed with the least amount of energy consumption. Some units also include digital flow meters, which enhance the ability to ensure (and record) accurate turbulent flow achieved to optimize each specific mold.

Most TCUs also feature user-friendly digital controls that make short work out of the necessary settings to ensure proper turbulent flow and temperature control from machine to machine and job to job. These controls also make it easy to monitor flow data and assess historical trends, to ensure consistency and repeatability.

Conclusion

Over the years, the importance of proper flow through a mold has become accepted, although this took quite some time. Pumps, whether they be in a chiller or TCU, must be carefully selected to achieve



optimum turbulent flow. Inadequate pumping capability assuredly leads to laminar flow and poor heat transfer, resulting in poor cycle times, part quality problems, increased scrap and, ultimately, loss of productivity. Temperature is an important factor, especially temperature control accuracy, but temperature alone usually takes somewhat of a back seat to flow. It is also notable that these same principles apply to blow molding, extrusion and any other fluid heat transfer process.

About the Author

Al Fosco has a Master of Science degree from the University of Illinois, specializing in heat transfer and fluid dynamics. He has held many engineering, sales and management positions, first with AEC, followed by Conair, and is currently Marketing Manager for Frigel North America.

For more information please visit www.frigel.com

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COOLING SYSTEM OPTIMIZATION

Deschutes Brewery and Holladay Park Plaza Save with THE ENERGY TRUST OF OREGON

By Rod Smith, Chiller & Cooling Best Practices Magazine

▶ Since 2002, Energy Trust of Oregon have saved and generated 728 average megawatts of electricity and 52 million annual therms of natural gas. This is enough energy to power Multnomah and Washington counties while heating Deschutes County homes. ETO has saved enough energy equal to the output of a power plant and reduced reliance on fossil fuels. In total, they have invested \$1.5 billion to save customers more than \$6.9 billion on their energy bills over time. They have also added \$5.7 billion to the local economy, including \$1.7 billion in wages, \$312 million in small business income and employment equal to 4,700 full-time jobs lasting a decade. Carbon emissions have been cut by nearly 20 million tons, equal to removing 3.5 million



These new pumps help us to produce more beer with less energy. They boost product quality, and they cool our fermenters faster, so we get more tasty beer out the door."

- Ron Shoemaker, Maintenance Manager, Deschutes.

08/18

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BEST PRACTICES

COOLING SYSTEM OPTIMIZATION

cars from the roads for a year. Efficiency remains the least expensive energy resource Oregonians can buy. This affordable energy supply helps utilities avoid investment in new and more expensive energy resources. The following articles are just two examples of such success stories.

Deschutes Enjoys a Long Draft of Energy-Cost Savings

Deschutes Brewery has a long history of engaging in energy-efficiency projects, and is reaping the rewards: \$34,500 in estimated annual energy cost savings.

Deschutes Brewery PROJECT-AT-A-GLANCE

Energy-Saving Improvements

- Passive cooling
- Energy-efficient lighting
- High-efficiency glycol pumps with VFD
- Compressed air leak detection and repair
- High-efficiency foodservice equipment

Estimated Savings

- ♦ 473,000 annual kilowatt hours
- ♦ 6,300 annual therms
- 237 annual tons of carbon dioxide

Financial Analysis

- \$34,500 estimated annual energy cost savings
- \$153,300 project costs
- \$36,500 in Energy Trust cash incentives

In 2004 when Deschutes Brewery went through a major expansion of its Bend brewing facility, the brewery made sure its new 40,000-squarefoot warehouse was a model of efficiency. Built to exceed Oregon energy code, the wellinsulated concrete warehouse maintains a 64 °F temperature year-round by taking advantage of free cooling available from Central Oregon's cool night air. Both the warehouse and the packaging line have low-wattage T5 high-





DESCHUTES BREWERY AND HOLLADAY PARK PLAZA SAVE WITH THE ENERGY TRUST OF OREGON

output fluorescent lighting and occupancy sensors.

Deschutes' brewing operation is fueled by energy-efficient boilers with stack economizers that reclaim heat from the ue gas and loop it back into the feed water. In addition, a vapor condensing heat exchanger on the brew kettle helps preheat the next batch of brewing water. Deschutes also replaced four inefficient glycol pumps on its chilled water system with two new efficient glycol pumps with variable frequency drives. "These new pumps help us to produce more beer with less energy," said Ron Shoemaker, maintenance manager, Deschutes. "They boost product quality, and they cool our fermenters faster, so we get more tasty beer out the door."

The brewery has worked closely with Energy Trust over the years, receiving a total of \$36,500 in cash incentives to support nine energy-efficiency projects. An effort that reaped considerable estimated savings — more than 181,000 kilowatt hours annually — resulted from participating in Energy Trust's custom operations and maintenance offer in which Energy Trust experts helped identify and repair compressed air leaks and set up an internal leak detection program so the savings persist.

Energy Trust also helped Deschutes outfit its Portland brewpub with a high-efficiency heating, ventilating and air conditioning system as well as energy-efficient foodservice equipment ranging from an infrared gas fryer to a high-efficiency freezer.

Deschutes is quick to share its experience with others. "Oregon breweries are a tight group," said Shoemaker. "We take advantage of what each of us has learned about making great beer using less resources."

To learn more about technical services and cash incentives available to eligible businesses located in the Energy Trust of Oregon service territory for energyefficient equipment upgrades, please visit www. energytrust.org/industry

Holladay Park Plaza Upgrades Chiller and Trims Annual Energy Costs

Life at Holladay Park Plaza, a continuing care retirement community in Portland, is geared toward living life to the fullest. And comfort is a key ingredient. When the 50 year-old chiller that serves Holladay Park's 16-story Tower Building could no longer keep up with demand, it was a problem that needed prompt attention. Temperatures were inconsistent, particularly during spring and fall when the 382,000 square-foot building went from heating to cooling in the course of a day. In



We'll save over \$16,700 in utility bills each year because we upgraded to a new energy-efficient water-cooled, magnetic- bearing centrifugal chiller that keeps our 382,000 square-foot building at a consistent temperature all day long. Plus, Energy Trust gave us over \$47,900 in cash incentives just for upgrading."

- Marty Rowe, Director Facility Services, Holladay Park Plaza Assisted Living

08/18

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the heat of the summer, the chiller couldn't deliver comfortable temperatures to Holladay Park's 270 residents.

Having worked with Energy Trust of Oregon on ten previous energy improvements, Holladay Park decided to add a new chiller to its list of improvements.

Energy Trust arranged for a technical study to outline the costs and savings of different energy-efficient chiller options. After Holladay Park made its selection, the retirement community received more than \$47,900 in Energy Trust cash incentives to help offset the cost of the project.

The new 375-ton, water-cooled, magneticbearing centrifugal chiller has a variable frequency drive and sophisticated direct digital controls. Unlike the old chiller, it excels at part-load performance — sensing outside and inside temperatures and precisely adjusting

Holladay Park Assisted Living PROJECT-AT-A-GLANCE

Equipment Installed

- Centrifugal magnetic-bearing chiller with variable frequency drive
- Direct Digital Controls

Financial Analysis

- \$47,964 in cash incentives from Energy Trust
- \$95,927 project costs
- \$16,700 estimated annual energy cost savings

Estimated Annual Savings

- 223,000 annual kilowatt hour savings
- 85 tons annual carbon dioxide savings



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DESCHUTES BREWERY AND HOLLADAY PARK PLAZA SAVE WITH THE ENERGY TRUST OF OREGON



output to match demand. Now, residents are comfortable even if the outside temperature swings from hot to cold in a matter of hours. "With the old chiller, we had to try to make those adjustments manually, often with limited success," said Marty Rowe, director of facility services, Holladay Park. "The new system is so much more efficient and responsive. It also requires less maintenance and is quieter."

The chiller's electronic controls allow facilities personnel to monitor the system online and make adjustments from any location. With the chiller located two levels below grade, removing the old chiller and installing the new model posed a logistical challenge.

The Solution?

Energy Trust trade ally contractors dismantled and removed the old equipment. They then took apart the new chiller and reassembled it in the mechanical room to meet their fast-track schedule.

Now, all areas of Holladay Park Plaza from resident apartments to offices, restaurant and swimming pool — are comfortable year-round, and Holladay Park is saving an estimated \$16,700 on annual energy costs. BP

To learn more about technical services and cash incentives available to eligible multifamily properties located in the Energy Trust of Oregon service territory for energy-efficient equipment upgrades, please visit www.energytrust.org/multifamily

All photos courtesy of Energy Trust of Oregon. To learn more about energy efficiency for industrial facilities, visit www.energytrust.org or call 1.866.368.7878.

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Exhibitors

- 81 Bay Controls
- 83 Ultrachem
- Sauer Compressors USA 85
- 90 Coaire
- 91 PneuTech
- 94 Fluid-Aire Dynamics
- 96 Case Controls
- TRI Air Testina
- 97
- 101 Sullair
- Howden Roots 106
- 107
 - ELGi Compressors USA
- Airleader 207 209 DV Systems 210 Edgetech Instruments

111

112

113

201

212 Compressed Air

110 ENERGY STAR

Group

EnergAir Solutions

Association of

Independent

Compressor

Distributors

Sullivan-Palatek

AABC Commissioning

- Challenge
- 300 VPInstruments 301 ComEd Energy Efficiency Program
- 304 Isel 305 Air Services Company
- Van Air Systems 306 Atlas Machine & 307
- Supply Solberg Filtration 308
- 311 nano-purification
- solutions 400 JORC Industrial
- 401 Kaeser Compressors
- 406 SPX FLOW 407 Parker 408 Mikropor America 413 MTA USA

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801

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Evaporative Cooling TOWER INNOVATIONS

By Glenn Brenneke, VP – Research and Development, Engineering and Product Management, SPX Cooling Technologies

► Cooling tower customers want product innovations that can give them a greater amount of cooling for the energy used. In this age of shrinking operational budgets, they also seek ways to reduce installation and maintenance costs. These customer needs cut across industry lines, whether for light industrial or heating, ventilation and air conditioning (HVAC) applications, or for power and process cooling operations.

To address these needs and develop the next generation of innovative evaporative cooling tower products, SPX Cooling Technologies focuses on voice-of-the-customer input, trade organization activities, and validation of new concepts through product testing.

Innovative designs driven by voice of customer

It's not always easy to interpret what the market is signaling. At SPX, product managers regularly collect voice-of-the-customer information, analyze it, and translate it into new concepts that can ultimately turn

into product specifications. Additionally, innovative ideas can emanate from industry organizations that monitor trends and regulations, such as the Cooling Technology Institute (CTI), Air-Conditioning, Heating, and Refrigeration Institute (AHRI), and American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).

One example of an innovation that emerged directly from specific customer input is the Marley[®] LW Fluid Cooler, an induced-draft counterflow closed-circuit fluid cooler. The design incorporates an innovative new heat transfer technology and a closed-circuit design that keeps the process fluid in a clean closed loop. In light of shrinking budgets and skilled labor pools, the LW Fluid Cooler is a response to market demand for products that offer installation and maintenance advantages.

According to a contractor who installed the LW Fluid Cooler in a Columbus, Ohio office building, the arrival of the product at the job

08/18

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site fully assembled and factory wired makes a substantial difference and reduces total installation time to about one day. Electrical subcontracting costs are also minimized due to factory-wired controls. In addition, the LW Fluid Cooler utilizes electronically commutated (EC) direct drive fans that eliminate the need for a separate variable frequency drive and require virtually no maintenance.

The new Fluid Cooler design was also installed at a Virginia Beach, Virginia hotel, where low sound was another deciding factor. The hotel operator especially appreciated that business could continue as usual during installation. While some fluid coolers can require four or five days to install, the LW Fluid Cooler was installed in one day.

Another example of innovation driven by customers is the Marley[®] NC[®] Everest Cooling Tower, developed to address the need for higher cooling efficiency and quiet tower operation. The factory-assembled, crossflow tower design offers 50 percent more cooling capacity per cell and uses up to 35 percent less fan power per ton of cooling compared with other single-cell, factory-assembled cooling towers.

In addition to lower energy costs, the new technology also significantly reduces HVAC system installation costs. The NC Everest tower's larger per cell cooling capacity reduces the number of electrical and piping connections, which saves labor and material costs during assembly. The modular design speeds installation, a significant consideration, particularly for process cooling operations that need to replace the cooling tower but have only a short outage window to complete the project.

For example, when a highly secure data center in New York couldn't afford exposure



To address customer requests for a factory-assembled cooling tower with higher cooling capacity, lower energy use and faster installation, SPX Cooling Technologies developed the Marley[®] NC Everest[®] Cooling Tower. The cooling tower offers 50 percent greater cooling capacity and uses up to 35 percent less fan power than comparable products in the market.



Mechanical contractors want reliable HVAC products that are faster and easier to install. The Marley[®] LW Fluid Cooler, which ships in one piece and fully wired, typically installs in less than a day.

EVAPORATIVE COOLING TOWER INNOVATIONS



The technological advances identified at the SPX Research and Development Center have helped establish global standards for process cooling and for individual components.



Voice-of-the-customer information is a vital part of new product development. Product managers and design engineers are charged with translating and analyzing it, testing concepts and ultimately turning them into viable products.

to unauthorized personnel for an extended period of time, it efficiently replaced a fielderected cooling tower with an NC Everest Cooling Tower. At this site, it only took five business days to install 5,000 tons of cooling capacity. If the customer opted for a fielderected alternative, it likely would have taken six to eight weeks to complete.

Innovations driven by industry activism

Regardless of application or industry, contractors and end users want products that install without complications, operate reliably throughout their service life, and do not require frequent maintenance.

In addition to listening carefully to and understanding customer needs, SPX Cooling Technologies engineers and scientists actively participate in industry trade associations and monitor governmental agencies and other organizations that establish recommendations, guidelines and regulations that impact cooling tower design, operation and maintenance.

For example, SPX is closely allied with ASHRAE and serves on various committees to improve safe and effective evaporative cooling, refrigerant uses and fan efficiency. SPX is a strong proponent of ASHRAE Standard 188 – Legionellosis: Risk Management for Building Water Systems, which provides guidance on the development and execution of effective cooling tower water management plans.

SPX is also a member of the Alliance to Prevent Legionnaires' Disease, a nonprofit coalition of health advocates, health providers, building engineers, scientists, water treatment experts and manufacturers, actively working to educate residents, building owners, policy makers, media representatives, water system managers and professionals, and government

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officials about the facts surrounding water quality, effective strategies for addressing the root causes of Legionnaires', and better protecting public health.

Innovations driven by research and development

The SPX Research and Development Center, located in Kansas City, Missouri, generates and validates new product concepts, and conducts rigorous product testing to evaluate function and viability. The Research and Development Center also conducts continuous product training for SPX associates and commercial partners to ensure they understand the design and operation concepts behind Marley towers and components. Customers also frequently visit to view first hand tests of performance, efficiency and reliability of cooling towers and their components, which are designed and modeled in house.

The SPX Research and Development Center is located in a climatecontrolled, energy-efficient space that was originally a limestone cave. It occupies three acres underground, taking advantage of its controlled environment year-round. Above ground, seven acres provide ample space to build and test prototypes and new design concepts.

Specific research areas of cooling tower technology include fan development, thermal performance testing, sound and vibration testing, water distribution, heat exchange fill media modeling and destructive testing. The technological advances identified at the Research and Development Center have helped establish global standards for process cooling and for individual components. SPX Cooling Technologies has been granted more than 181 U.S. patents for cooling tower designs and components.

Innovation requires collaboration

To broaden a company's mindset and advance product development, it's not enough to talk to customers and industry leaders; one must learn to listen intently and interpret effectively. Regularly connecting with customers, industry peers and other colleagues empowers ongoing feedback, smart conversations and solid ideas. To quote business guru and management expert Ken Blanchard: "None of us is as smart as all of us." BP

For more information please visit www.spxcooling.com

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Join Keynote Speaker, Mark Ames, Senior Auditor for John Henry Foster, to review the Quality Standard for Instrument Air and designing proper compressed air treatment. Standard ISA-7.0.01-1996 allows for compressed air dew point to vary, challenging the specification for a constant -40°F dew point. Mr. Ames will discuss how to meet the ISA standard for all operating conditions, reduce flow restriction and desiccant dryer purge and ultimately reduce compressor energy consumed for over drying compressed air.

Our Sponsor Speaker is Robert Bailey, Product Manager for Kahn Instruments whose presentation is titled "Using Capacitive Dewpoint Sensors in Compressed Air Systems." Of the many sensor technologies available for measuring the dewpoint of compressed air, capacitive dewpoint sensors are very common. Mr. Bailey will discuss their responses to rapid dewpoint changes and applications with different dryer types. He will also discuss different system locations from on-board the dryer to downstream the compressed air system.

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Mark Ames is the Senior Auditor for John Henry Foster.



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COOLING TOWERS & CHILLERS

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Modular Cooling Blocks Revolutionize DATA CENTER ENERGY USAGE

By Lisa Tryson, Director of Corporate Communications, Danfoss

► Data centers are a lynchpin of our modern economy. Server rooms power small- to medium-sized businesses, enterprise data centers support major corporations and server farms host cloud computing services. Keeping up with the explosive growth of digital content, big data, e-commerce and Internet traffic is making data centers one of the fastest growing consumers of electricity in developed countries.

In fact, data centers use nearly 2 percent of the world's supply of electricity at any given time, and 37 percent of that amount is used to keep

computing equipment cool. Not only is this a drain on the power grid, but it also taxes water supply. A 15-megawatt data center can use up to 360,000 gallons of water a day — that's more than half the water in an Olympic-size swimming pool.

Data center power consumption is on the rise, increasing 56 percent worldwide and 36 percent in the U.S. from 2005-2010. These substantial energy demands come at a price, and controlling operational costs in data centers has been a persistent challenge. IT systems are designed to ramp up and down based on a businesses' use, yet cooling systems in data centers were not previously designed to do that.

Traditional data centers can incur excessive energy expenses from three main cost drivers:

- > Over-building a data center
- Underutilizing the data center that has been built
- Inefficiently using cooling technology

"The Turbocor™ compressor we feel is by far the most efficient compressor that's on the market, and it fits very well with the just-in-time delivery and also the ability to go from very low loads to very high loads."

- Earl Keisling, CEO, Inertech

CHILLER & COOLING BEST PRACTICES

Cost-saving Energy Solutions

Aligned Energy, an integrated technology platform, has developed a solution that eliminates infrastructure complexity and waste, heightens visibility and control, and improves reliability in data centers. One of Aligned Energy's subsidiary companies, Inertech, set out to address the key drivers of cost in data centers. With 80 percent of a data center's costs going towards the electrical and mechanical systems, Inertech determined that the only way to effect real change is to drive down the cost of the cooling system and electrical blocks.

Using Danfoss' portfolio of products and application expertise, Inertech was able to develop a solution for scaling mechanical and energy infrastructure directly to servers and storage use, which has yielded enormous savings in water and electricity costs.

Evaluating Cost Drivers

The majority of a data center's upfront costs are in building chiller infrastructure. The average data center is constructed to a "perceived build" based on the anticipated IT capacity. Companies try to predetermine the size of chiller plants needed to support IT, however these calculations are highly complex and difficult to accurately predict. Often, companies significantly overbuild data centers from day one, unnecessarily inflating their capital costs.

Operators of existing data centers working under this model were spending nearly 85 percent of their capital expense upfront, but they were applying this capital towards equipment that was going unused. These operators would start up their IT kits, and learn that they were running a much lighter load than what they had built for.

Earl Keisling, CEO of Inertech, explained that, "IT systems are designed, like in the financial industry, to 'follow the sun around.' These



systems are designed to support very high loads in a given area, whether it be Hong Kong, or the London stock exchange, but have to be able to support low loads as well. The problem with the original technology – these large chiller plants – is that they only work well when they're fully loaded, because that's what they were designed for."

Keisling added that when data centers are operating they never draw more than 60 percent

of the wattage listed on the server name plate. "Therein lies the problem — that you designed a system for servers, and your utilization is only a fraction of what that name plate is."

If companies overbuild their cooling systems, or install products they aren't using, it is both operationally and fiscally inefficient. The lack of a supply chain model that scales products to requirements has fueled the perpetual repetition of this costly practice.

MODULAR COOLING BLOCKS REVOLUTIONIZE DATA CENTER ENERGY USAGE

Collaboration between Danfoss and Inertech Yields Innovative Solution

Using Danfoss products, Inertech's patented model has been able to reduce 80-85 percent of the cost of starting a data center on day one. On the operational side, because Inertech's cooling systems are 90 percent more efficient than a traditional chiller plant, it is able to drastically cut the electrical infrastructure that supports that data center for its customers.

Inertech did this by building a platform of small modular cooling blocks that can be scaled to actual IT use. It worked with Danfoss to identify critical components of the Danfoss portfolio that would enable Inertech to maximize efficiencies for energy and water





use. The system design supports data center needs in a much more cost-effective delivery model than a traditional chiller plant, as the smaller platforms can be installed exactly when they are needed, or 'just-in-time,' without interrupting IT online operations.

Inertech's cooling cycles were designed to be delivered modularly, both in the equipment, as well as in the physical infrastructure, enabling data centers to scale over time. Working in a supply chain of four to six weeks, Danfoss and Inertech deploy and hook up pre-assembled modular units to data centers based on their actual IT use, which has resulted in energy efficiency of 80-90 percent versus a normal chiller plant.

"We have utilized Danfoss' [Turbocor[™] compressor and heat exchangers] in our CDU's [cooling distribution units] and in our Cactus Units," said Keisling. "The Turbocor[™] compressor we feel is by far the most efficient compressor that's on the market, and it fits very well with the just-in-time delivery and also the ability to go from very low loads to very high loads."

A traditional 10 MW data center would typically have 20 MW of power in order to have sufficient power to get the chiller plant back online in the event of a power outage. Modularizing the system with small Danfoss Turbocor[™] blocks resulted in very low in rush, only using the compressors as needed, which reduced the electrical infrastructure required from 100 percent overhead down to 15 percent. This makes Inertech's solution more reliable than any other system currently on the market, and less risky to data centers.

Inertech's Cactus Units use about 80-85 percent less water than a traditional chiller plant. This particular unit also affords data centers the ability to run dry, providing added

BEST PRACTICES

CHILLER & COOLING

flexibility to compensate for the atmosphere and surrounding conditions.

"We've created efficiencies in both energy and space," said Marcus Moliteus, vice president of sales and engineering at Inertech. "By doing that we can provide our clients with a modular chiller plant or cooler solution in 350-500kw modular blocks. We've worked closely with Danfoss to reduce amperage on the Turbocor™ compressor the way we apply it in our patented cycle, and by doing so have created efficiencies beyond what the original product intended."

Separating the chiller plant into small modular blocks has enabled Inertech to operate each of the individual circuits to very high efficiency. When it comes to data centers, reliability is paramount. Inertech's "use" model is an innovative approach to addressing overbuilding, underuse and inefficient cooling infrastructure in many data centers today. When prefabricated modular units are delivered to site for clients. "there is no on-site installation," said Moliteus. "You literally land and connect onsite, and using the variable frequency drives (VIT[™] Drives) helps in reducing the amount of energy and wiring on site. It allows clients to have quicker deployments in places where it is harder to find labor, as data centers can be in remote places. This is also beneficial because there is zero shut down time, so it doesn't impact the running data center."

The collaboration has enabled Inertech to create multiple efficiencies, reduce the overall environmental footprint and drive down costs for its customers.

Lenovo Case Study

Inertech used Danfoss' solutions to help the world's largest personal computer (PC) manufacturer, Lenovo, with its data center challenges. When Lenovo purchased IBM's



server and PC divisions, the company needed to rapidly migrate IBM's testing gear and laboratories over onto its platform.

"When you come out with new technology in the data center business, the key and most important aspect in all of it has to be reliability," said Keisling. "Inertech had to develop and use products that used best-inclass equipment in order to convince engineers and builders that this is for real."

Despite getting involved with Lenovo late in the migration process, Inertech and Danfoss were able to quickly develop solutions for two locations, a high-density lab in Santa Clara, California and a facility in Raleigh, North Carolina.

With California facing one of the most severe droughts on record, Inertech devised a solution for Santa Clara that was able to operate the systems dry for most of the year, consuming 80 percent less water than a typical chiller system.

Both facilities now use 80-90 percent less power on the cooling infrastructure due

to Inertech's design, powered by Danfoss compressors, heat exchangers and drives.

Powering Co-locations

Many of the world's data centers are moving into co-locations to control costs. In November 2015, Aligned Data Centers opened the first 300,000-square-foot data center with a power capacity of 30 MW in Plano, Texas, with another site slated for Phoenix, Arizona in 2016 that will add another 65 MW of capacity. These facilities offer a unique responsive data center model in the co-location space that is designed for real world server usage.

Using reliable products and expertise from Danfoss has enabled Aligned Energy and Inertech to create smart solutions that improve efficiency and lower energy costs in an industry that powers the future.

All photos courtesy of Danfoss. For more information, visit www.danfoss.com.

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INDUSTRIAL COOLING SYSTEM INDUSTRY NEWS

Johnson Controls Grand Opening of R&D Complex in Pennsylvania

Johnson Controls held a grand opening for its new Advanced Development & Engineering Center in York County, Pennsylvania, introducing the complex to the media and federal, state and local dignitaries.

Located in the Stonebridge Business Center, 5000 Renaissance Drive, New Freedom, Pennsylvania, the complex includes a 250,000-square-foot testing lab and support facility, which consolidates testing facilities from Johnson Controls' existing campus located 15 miles north in York, Pennsylvania. In addition, the complex features a 107,000-square-foot engineering office building.

"Our customers expect the best, and we will continue to deliver the best – industry-leading HVACR equipment, such as our new YORK[®] YZ chiller," said Bill Jackson, president, Global Products, Johnson Controls. "This world-class facility enables us to advance performance levels for customers, thanks to more than 400 dedicated and driven employees, as well as business partners in the York County community."

The grand opening included a ribbon-cutting ceremony and comments from project stakeholders, followed by guided tours of the facility.

The complex represents Johnson Controls' continued investment and leadership in the HVACR industry. The new testing lab will allow Johnson Controls to deliver the most innovative and highest quality products in the industry. In addition, it complements the R&D facility in Wuxi, China, and its newly opened world-class Asia-Pacific headquarters in Shanghai, China, featuring industry-leading green and smart buildings.

Jacobs, a global company that served as the project architect, is seeking Leadership in Energy and Environmental Design (LEED) Silver certification from the U.S. Green Building Council for the York County complex. LEED is a rating system that evaluates the environmental performance of a building and encourages market transformation toward sustainable design.

The testing lab rises to 60 feet in some areas to accommodate YORK[®] brand chillers, including the new YZ chiller, and YORK[®] air handling units (AHU). The facility features over 20 labs, including air-cooled and water-cooled, acoustic, power electronics, compressor, air handling units and various other labs to spur innovation. The facility also houses a training center for variable refrigerant flow (VRF), chiller and other products and technologies.

The complex is a joint venture between McCarthy Building Companies, Inc. (St. Louis), PJ Dick (Pittsburgh) and Stewart & Tate Construction (York). Seventy-five percent of the construction work was completed by Pennsylvania firms, and 1,869 workers completed safety orientation on site, resulting in zero lost-time injuries.

"As a one-of-a-kind, large-scale, advanced development and engineering lab facility, the Johnson Controls project had a number of unique construction challenges," said Ryan Molen, LEED BD+C, Project Director-Advanced Technology & Manufacturing, McCarthy Building Companies, Inc. "In addition to balancing flexibility in systems and building components for technologies that are rapidly changing and advancing in complexity, McCarthy was focused on driving efficiencies in cost and schedule."



Johnson Controls' new research and development complex in York County, Pennsylvania.

For more information about Johnson Controls, go to www.johnsoncontrols.com. To see a video of the grand opening, visit http://www.johnsoncontrols.com/buildings/ campaign/jadec.

About Johnson Controls

Johnson Controls is a global diversified technology and multi-industrial leader serving a wide range of customers in more than 150 countries. Our 120,000 employees create intelligent buildings, efficient energy solutions, integrated infrastructure and next generation transportation systems that work seamlessly together to deliver on the promise of smart cities and communities. Our commitment to sustainability dates back to our roots in 1885, with the invention of the first electric room thermostat. We are committed to helping our customers win and creating greater value for all of our stakeholders through strategic focus on our buildings and energy growth platforms. For additional information, please visit http://www.johnsoncontrols.com or follow us @johnsoncontrols on Twitter.

About Johnson Controls Building Technologies & Solutions

Johnson Controls Building Technologies & Solutions is making the world safer, smarter and more sustainable – one building at a time. Our technology portfolio integrates every aspect of a building – whether security systems, energy management, fire protection or HVACR – to ensure that we exceed customer expectations at all times. We operate in more than 150 countries through our unmatched network of branches and distribution channels, helping building owners, operators, engineers and contractors enhance the full lifecycle of any facility. Our arsenal of brands includes some of the most trusted names in the industry, such as Tyco[®], YORK[®], Metasys[®], Ruskin[®], Titus[®], Frick[®], PENN[®], Sabroe[®], Simplex[®] and Grinnell[®]. For more information, visit www.johnsoncontrols.com or follow @JCI_Buildings on Twitter.

SPX Cooling Technologies Introduces MarleyGard[™] Water Management Products

SPX Cooling Technologies, Inc., a full-line, full-service industry leader in the design and manufacture of cooling towers and other specialized heat exchangers, introduces the MarleyGard[™] CD Chemical Delivery System and MarleyGard SP Basin Sweeper Piping System.* The preassembled MarleyGard CD and SP Systems install quickly and help maintain cooling tower water quality. The MarleyGard CD Chemical Delivery System uses electronic monitoring to evaluate the delivery of cooling water treatment and its effectiveness in keeping the control parameters within specified limits. By using this type of control, a technician is dispatched only when problems requiring on-site resolution are encountered. Primary monitoring targets typically include conductivity, oxidation reduction potential (ORP), treatment chemical concentration levels, general water analysis, and corrosion coupons and probes.

As cooling tower operations vary by site and water conditions, quality guidelines, chemical specifications and other circumstances, the MarleyGard CD Chemical Delivery System provides multiple, configurable options for certified water treatment professionals to work



The MarleyGard[™] CD Chemical Delivery System uses electronic monitoring to evaluate the delivery of cooling water treatment

INDUSTRIAL COOLING SYSTEM INDUSTRY NEWS

the MarleyGard CD control panel. The basic panel includes a controller, conductivity probe, chemical pumps and injection ports. Additional options offer a communication controller, solenoid and blowdown, corrosion rack or corrosion meters, and more. The MarleyGard CD System also provides easy-to-use set points, calibration and timers.

To complement the chemical delivery system, the MarleyGard SP Sweeper Piping System uses nozzles to "sweep" solids toward the sweeper outlet suction pipe, discouraging the formation of biofilm, scale and corrosion. The suspended solids travel through the pump suction pipe to a separator or filtration equipment (supplied separately), where they are removed and clean water is pumped back to the basin via the PVC piping and nozzles. Turbulence created by the nozzles further inhibits biological growth.

Implementing effective water management plans is an essential part of cooling tower operations. MarleyGard water management products maintain and protect cooling towers by helping to minimize conditions that can lead to biological growth, corrosion and scaling.

*SPX Cooling Technologies designs and manufactures cooling towers and other specialized heat exchangers, and provides water management products to support the execution of an effective water management plan (WMP) as outlined in ANSI/ASHRAE Standard 188-2015. Professional water treaters should be consulted to perform chemical delivery services.

For more information, visit www.spxcooling.com

About SPX Cooling Technologies, Inc.

SPX Cooling Technologies, Inc. is a leading global manufacturer of cooling towers, evaporative fluid coolers, evaporative condensers and air-cooled heat exchangers providing full-service cooling solutions and support to customers in the power generation, petrochemical, industrial, refrigeration, and heating, ventilation and air conditioning (HVAC) markets for 95 years. SPX Cooling Technologies and its product brands are part of SPX Corporation. For more information, please visit www.spxcooling.com.

About SPX Corporation

SPX Corporation is a supplier of highly engineered products and technologies, holding leadership positions in the HVAC, detection and measurement, and engineered solutions markets. Based in Charlotte, North Carolina, SPX Corporation had approximately \$1.4 billion in annual revenue in 2017 and more than 5,000 employees in about 15 countries. SPX Corporation is listed on the New York Stock Exchange under the ticker symbol "SPXC." For more information, please visit www.spx.com.

New Research Reveals Benefits of Thermal Energy Storage on the U.S. Grid and Managing Energy Supply

Study discovered utilities under-predict value of Thermal Energy Storage by up to 77 percent

Ingersoll Rand (NYSE:IR), a world leader in creating comfortable, sustainable and efficient environments, engaged with Western Cooling Efficiency Center at University of California, Davis, on research that shows thermal energy storage can provide significantly greater benefits to utilities and electricity grid operators than previously thought.

"This study will help utility companies and building operators optimize resource planning and energy use by capturing the full value of thermal energy storage, which uses an **energy storage** tank and ice to shift cooling needs to off-peak, night time hours," says Scott Tew, from Ingersoll Rand's Center for Energy Efficiency and Sustainability, which co-sponsored the study. The research project: Valuation of Thermal Energy Storage for Utility Grid Operators, demonstrated that the current method for estimating the electrical grid impact of Thermal Energy Storage systems does not fully consider the impact of energy savings that occurs during the hottest days of the year, which means that estimates are far lower than previously thought. By basing estimates on a "10-day average baseline," the data drastically under-estimates the impact of disconnecting the cooling system from the electric grid when temperatures outside are very hot and the grid reaches its peak load conditions. The current method under-predicts its impact on the electric grid by as much as 77%, between 38% and 57% on average, and by a minimum of 3%. The current method does not adequately account for shifts in building loads due to holidays, weekends or extreme events, when thermal energy storage can save the most energy by disconnecting cooling from the grid.

"Power consumption is forecasted to grow, yet more than 72 gigawatts of electrical generating capacity has either already retired or is set to retire," said, Mark Modera, director of Western Cooling Efficiency Center at University of California, Davis. "These factors have created an increasing urgency for power providers to find solutions that will allow them to accommodate the growing consumption needs and peak demand requirements in the U.S."

These findings reinforce the sustainable, financial and connected benefits of thermal energy storage and provide a new approach for utility companies to consider to better estimate the electric grid impact of Thermal Energy Storage as they plan resources and service costs.

Whole-building simulations were used to model the electric grid impact of thermal energy storage systems. The simulations



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Sustainable Energy & Water Savings with Chiller & Cooling Best Practices

Chiller & Cooling Best Practices is a technical magazine dedicated to discovering Energy and Water Savings in industrial chiller and cooling systems. Our editorial focus is on case studies and technical articles where application and system knowledge drives technology selection, creating energy savings in projects delivering excellent ROI's.

"The average tape plant has plastic extruder motors and electric beated dyes as the largest energy consumers. Other consumers are chilled water (20%), compressed air (3%) and lighting (1%). We look at chiller set-points and try to maximize them for energy efficiency. At our Danville plant, we have a capacity of 5,000 tons of cooling managed by over fifteen chillers."

- Michael Jones, Corporate Energy Team Leader, Intertape Polymer Group

From Chillers, Dry Coolers and Cooling Towers to Hydronic Specialties and Master Controls

Our readers embrace Sustainability as a profitable business opportunity. We believe the industrial process cooling and HVAC installed base to be at a tipping point — one where "energy and water retrofits" will fuel a new era of market growth, similar to what we've seen in the compressed air industry. Better applying more varied cooling technology combinations to better understood partial-load demand profiles will fuel system improvements. This will combine optimizing system components and using master controllers to further improve efficiencies.

"VSDs can cut a chiller's annual energy use by up to 30 percent while maintaining operating reliability."

 Fred Berry, Chiller Channel Manager, Johnson Controls ("VSD Chillers Deliver Energy Savings Under Real World Operation," May 2017 Issue)



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were performed on three building types using five types of cooling systems in three California climate zones. Trane[®] TRACE 700 Load Design software simulated each building model and produced hourly cooling loads for each of the buildings. The cooling loads and ambient weather conditions were used to calculate the electric-grid impacts incurred from meeting the loads using each type of cooling system, as compared to using a thermal energy storage system.

These results will be showcased as Trane experts attend the Energy Storage Association's (ESA) 28th Annual Conference and Expo in Boston, April 18-20, to discuss the next evolution of energy storage solutions. The full report and research findings are available for download on the Western Cooling Efficiency Center's website. The full report and research findings are available for download at trane.com/energystorage. The full report and research findings are available for download on the Western Cooling Efficiency Center's website.

About Ingersoll Rand and Trane

Ingersoll Rand (NYSE:IR) advances the quality of life by creating comfortable, sustainable and efficient environments. Our people and our family of brands — including Club Car®, Ingersoll Rand®, Thermo King® and Trane[®] — work together to enhance the quality and comfort of air in homes and buildings; transport and protect food and perishables; and increase industrial productivity and efficiency. We are a \$13 billion global business committed to a world of sustainable progress and enduring results. Trane solutions optimize indoor environments with a broad portfolio of energy efficient heating, ventilating and air conditioning systems, building and contracting services, parts support and advanced control. For

more information, visit www.ingersollrand. com or www.trane.com.

About Western Cooling Efficiency Center

The Western Cooling Efficiency Center was established alongside the UC Davis Energy Efficiency Center in 2007 through a grant from the California Clean Energy Fund and in partnership with California Energy Commission Public Interest Energy Research Program. The Center partners with industry stakeholders to stimulate the development of cooling technologies that can reduce energy demand, and water consumption in buildings.

The Center engages in primary research, innovation, laboratory testing, field demonstrations, education, outreach, and advocacy related to climate appropriate cooling technologies.

Daikin Applied Proposes Expanding Minnesota Manufacturing Presence

Daikin Applied announced its proposal to expand production capabilities with a new state-of-the-art, built-to-order manufacturing facility in Southern Minnesota, north of the city of Faribault.

Daikin Applied is a division of Daikin Industries, the world's number one air conditioning company headquartered in Japan. As the global HVAC leader, Daikin Industries has more than 90 production bases around the world to meet the specific needs of regional world markets, including two successful US plants in Faribault and Owatonna, Minnesota. Daikin Industries' executives and team members explored multiple site options outside of the US, in different regions of the US, and different Minnesota locations; and have recognized Southern Minnesota as the best opportunity for the planned state-of the-art manufacturing facility, given the region's skilled talent base and past achievements in designing and producing complex, highly specified equipment.

Vice President and General Manager Will Fort leads operations at both Minnesota plants, and will spearhead the development of this new factory. "We have grown our operation within the city of Faribault over fifty years. In 2000, we opened the Owatonna factory, and completed a major expansion there in 2014 to triple its size," said Fort. "Our strong growth in recent years is the result of having highly skilled people in the plants, expert product design and marketing teams in our Plymouth headquarters, and the commitment from Daikin Industries to manufacturing excellence."

Daikin Applied currently employs approximately 900 people in its factories in Southern Minnesota. As such, they have become a significant employer in the region. "We're fully invested in this community," said Matt Alexejun, Senior Director of Human Resources for manufacturing. "We know that our company only grows when our people grow. So we invest not just in the best training for our employees; we extend that commitment into the community by offering programs and training opportunities at local high schools and colleges."

"We certify master regional braze trainers through excellent Dojo training in Japan," said Fort. A Dojo is an immersive learning space. "The regional trainers then pass that international knowledge, skill and certification onto all our production braze operators, ensuring the quality of our product. No one else in the industry can do that." Daikin engages prospective employees in the community through partnerships and company-funded vocational programs at local colleges and high schools, securing training grants with the Minnesota Department of

08/18

Economic Development, and continues to invest in internal people-centered development programs. The new factory is expected to add significant new employment opportunities to the community.

Daikin Applied CEO Mike Schwartz said, "We have some of our best people in Minnesota and Japan partnering on this important project. We're also appreciating the cooperation and assistance of the civic leaders in St. Paul and Southern Minnesota to help make this happen." To that end, Jim Glen, manufacturing liaison engineer, who brings to the team over 28 years of manufacturing experience in the region, is actively engaged with the Minnesota Department of Employment and Economic Development, Rice County and the City of Faribault to finalize state and local government financial assistance approvals to support the infrastructure, investment and employment needs of the new facility. Approval of these financial resources at the local and state government levels is key to the project proceeding, and will allow transformation of the site and bringing the factory on line in 2019.

About Daikin Applied

Daikin Applied, a member of Daikin Industries, Ltd, designs and manufactures technologically advanced commercial HVAC systems for customers around the world. Customers turn to Daikin with confidence that they will experience outstanding performance, reliability and energy efficiency. Daikin Applied equipment, solutions and services are sold through a global network of dedicated sales, service, and parts offices. For more information or the name of your local Daikin Applied representative, call 800-432-1342 or visit, www.DaikinApplied.com.

About Daikin Industries Ltd.

Daikin Industries, Ltd. is a Forbes 1000 global company with 2017 revenues of nearly \$21 billion and more than 65,000 employees worldwide, making it the largest HVAC manufacturer in the world. Daikin is engaged primarily in the development, manufacture, sales and aftermarket support of heating, ventilation, air conditioning and refrigeration (HVACR) equipment, refrigerants and other chemicals, as well as oil hydraulic products. Daikin was named one of the world's most innovative companies by Forbes magazine. For more information, visit www.daikin.com.



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