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Jobs and Technology
Industrial cooling requirements, in a single plant, are as diverse as they are critical to ensure product and process quality. These two factors make cooling system design requirements unique to each plant and a real engineering challenge.

Our lead article, “Eliminating Catalyst Cool Down as Critical Path in a Turnaround,” provides an example of the critical nature of cooling systems in refineries and petrochemical plants. Written by Aggreko’s Turnaround Manager, Barney Smith, this article proposes replacing liquid nitrogen with a patented process (using a water/glycol solution in a heat exchanger) during the catalyst cool-down processes in hydrotreaters, hydrocrackers and reformers.

The 2016 AHR Expo provided a spectacular display of chiller, cooling tower, refrigeration compressors and circuits and measurement technologies. Serving industrial and commercial users and the specifying engineering firms, this industry is innovating like crazy to meet market demands for lower water and energy consumption as well as new greenhouse gas regulations. I hope you enjoy our Show Report on the booths I was able to visit.

Daikin Applied is one of the largest chiller manufacturers in the world. Their Director of Operations and Owner Sales, Joe Leichner writes, “While the chiller is the heart of a chilled water system, its support system of components and controls are equally critical to attain high efficiency levels.” His article titled, “Evaluating Chilled Water Cooling System Components,” reviews water pumps, cooling towers, heat exchangers, controls and hydronic specialty components.

Tower Tech is a cooling tower manufacturer based in Oklahoma City. They have provided us with an interesting article on how tower designs can impact water consumption rates and also chemical treatment requirements. For example, outside environmental factors, such as wind-blown sediments, can impact a system’s oxidizer demand, therefore requiring more chlorine to maintain a sufficiently high level of residual. A cooling tower can be designed to reduce outside environmental factors.

Lastly, we hope you enjoy my rather belated Show Report on chiller technologies at Process Expo. Previewing a couple snippets from the article, Dimplex Thermal Solutions described their 90-ton Koolant Kooler unit at Arcadia Brewing, Berg reviewed the cooling requirements of ice-making machines, Thermal Care described their 20-ton wash-down chiller, and Mokon described their Full Range unit able to offer both process heating and chilling in one package — to an extruder requiring water temperature control in 7 different zones. Seven zones in just one machine — talk about diverse requirements!

Thank you for investing your time and knowledge with Chiller & Cooling Best Practices and please remember to visit www.coolingbestpractices.com.

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Aggreko Replacement Chiller Restarts a Chemical Plant Within 12 Hours

A Gulf Coast chemical manufacturer of oxo derivative and intermediate products including alcohols, polyols, carboxylic acids, specialty esters, and amines experienced a failure in a critical chiller that shut down its entire Gulf Coast plant.

A plant manager estimated a potential financial loss of over $1,000,000 each day the plant was down. The incident occurred over the weekend and there was great concern that locating a replacement chiller with sufficient capacity would be challenging.

Third-party temperature control provider Aggreko deployed a replacement chiller and had it running along with a 1500kW generator within a day. It was originally expected that the temporary chiller would be necessary for only a few days until the plant’s permanent chiller could be fixed. However, after inspection the plant learned it would take over a month to complete its repairs.

Due to this longer time interval, the Aggreko generator was scheduled to be taken down for quick maintenance within two weeks. However, twelve days into the rental, Aggreko Remote Monitoring (ARM), a service that monitors and transmits critical information about Aggreko’s rental equipment, sent an alert to the Remote Operating Center (ROC) that the generator was running, but there was no load. This seemed unusual to the Aggreko technicians who immediately contacted the plant to assess onsite activity.

Aggreko was informed the plant had experienced an electrical emergency forcing them to fix its switchgear, thus Aggreko utilized this time and quickly mobilized a crew to the plant where they performed the necessary generator maintenance. This quick action averted another shutdown. Aggreko’s quick action both right after the initial chiller failure and during the unexpected switchgear issue, literally saved the client millions of dollars.

Johnson Controls Expands YORK YMC2 Centrifugal Chiller Line

Johnson Controls has enhanced its portfolio of commercial HVAC/R products with the expansion to 1,000 tons of cooling (3,500 kW) for its successful magnetic-bearing centrifugal chiller line, the YORK YMC2. The larger cooling capacity units address the need for reduced sound, high efficiency and low maintenance while advancing the future of chillers through magnetic bearing and oil free technology.

The chiller uses magnetic levitation technology in its driveline to spin without friction, offering a quieter, more efficient operation. The YMC2 also has a standard variable speed drive to further increase the efficiency of the chiller.

- Sound levels as low as 70 dBA for quiet operation
- YORK chillers are known for utilizing industry-leading low entering condenser water temperature to reduce energy usage. The YMC2 chiller is capable of achieving values below 0.1 kW/ton at part load, resulting in a significantly lower utility bill.

- The oil-free design delivers reliable operation and low maintenance, providing a lower total cost of ownership over the life of the chiller.

“The YMC2 chiller is an example of Johnson Controls’ ability to develop innovative solutions to solve our customers’ challenges,” said Laura Wand, vice president of global chillers, Johnson Controls Building Efficiency Business.

“In addition to the YMC2 chiller, our new offerings include a lower-cost air-cooled chiller and smart, connected chiller technology that supports optimized uptime. We have the industry’s best and most extensive product portfolio, and we intend to build on it to enhance our offerings to a diverse customer base around the world.” The complete YMC2 line now offers units from 165 – 1,000 tons (580 kW to 3,500 kW).

Visit http://www.johnsoncontrols.com or follow us @johnsoncontrols on Twitter.

Emerson Launches New Copeland Scroll™ Variable Speed Compressor

Emerson Climate Technologies, Inc., has launched the second generation of its Copeland Scroll™ variable speed ZPV2 compressor and EV2 motor control drive for residential and light commercial applications.

“Our second generation, variable speed ZPV2 compressors and EV2 drives are optimized to increase efficiency across a range of conditions while maintaining the reliability that Copeland Scroll technology traditionally delivers,” said Brandy Powell, vice president variable speed at Emerson Climate Technologies Air Conditioning Business.

The second generation Copeland Scroll variable speed ZPV2 compressor features intermediate discharge valves to boost efficiency, optimized scroll elements for variable speed performance, positive displacement oil pump for enhanced reliability in low speed operation and brushless permanent magnet (BPM) motor technology for maximum efficiency.

Integrated CoreSense™ technology is built into the new Copeland Scroll variable speed EV2
motor control drive for optimal compressor performance. Features include soft starting capability, controlled shutdown, scroll over temperature protection and high pressure cutout. In addition, the drive protects the compressor from operating outside of the design parameters and against electrical power variations.

The new Copeland Scroll variable speed compressors and motor control drives can enable system manufacturers to achieve industry leading 25+ Seasonal Energy Efficiency Ratio (SEER) and 13+ Heating Seasonal Performance Factor (HSPF). Homeowners and small businesses have experienced greater comfort and annual energy savings of up to 40% with HVAC systems featuring Copeland Scroll variable speed compressors.

Visit EmersonClimate.com.

Century Refrigeration Introduces N-Series Chillers

Century Refrigeration, a division of RAE Corporation, an industry leader in the design and production of engineered heating, cooling, and refrigeration systems, announced the availability of its N-Series Chillers. The N-Series Chiller provides all the advantages of a proven Century ComIndustrial design in a complete, factory run-tested chiller package engineered for durability and serviceability.

With a variety of available options and accessories, Century Refrigeration’s engineering experts can design and build N-Series Chiller units for a range of chilling applications with no need for modification in the field. The N-Series Chiller is constructed from high-quality components for the greatest possible durability, thereby optimizing efficiency and lengthening service life.

The N-Series Chiller features accessible components and appropriate fin spacing to allow for easy maintenance, and is designed to be serviceable with a minimal number of OEM components. Additionally, Century Refrigeration’s expert service technicians and large inventory of replacement parts ensures timely, professional, and reliable service throughout the chiller’s lifetime.

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Baltimore Aircoil Company Recognized at 2016 AHR Expo

Baltimore Aircoil Company (BAC) was recognized with a record three honorable mentions in the 2016 AHR Expo Innovation Award categories of Cooling, Green Building, and Refrigeration. Don Fetzer BAC’s President emphasized, “We’re pleased to be recognized for our investment in innovation and technology and for leading the evaporative cooling industry into the future.”

In the Cooling category, the New Series 3000 Cooling Tower continues its industry leadership winning an honorable mention. Coupled with the ENDURADRIVE ™ Fan System, the New Series 3000 is the only direct drive solution that eliminates powertrain systems in large capacity cooling towers. This fan system provides unmatched reliability, superior energy savings, and the lowest maintenance costs in the industry. The Series 3000 with the ENDURADRIVE Fan System now offers the largest single cell modular cooling tower in the world with 1,446 nominal tons! Additional ENDURADRIVE Fan System benefits include a “10% reduction in energy costs with no transmission or mechanical losses, significant energy savings, and a 90% reduction in maintenance costs compared to a traditional gear drive system,” Fetzer explained.

In the Green Building category, the PFi Closed Circuit Cooling Tower won honorable mention by offering customers the combination of direct and indirect heat transfer enhancing thermal efficiency by 30% or more. This engineered concept increases performance while enhancing the unit’s reliability for year-round operation. The PFi has the lowest installed cost compared to other counterflow closed circuit cooling towers due to a combination of the lowest weight, fan horsepower, and smallest footprint. It also features the lowest total cost of ownership with Extreme Efficiency models (XE Models) that reduce operating costs by up to 50%. This is all with the peace of mind that each PFi is CTI Certified for water and glycol for guaranteed performance. Fetzer added, “We’re pleased to have been recognized for the engineering and design innovation that contributed to the development of this new technology.”

Lastly, in the Refrigeration category the TrilliumSeries™ Condenser for Transcritical CO₂ Applications received honorable mention. With higher performance and lower operating costs, water cooled methods offer the best long-term investment for any cooling system. Systems with adiabatic heat rejection, such as the hybrid TrilliumSeries Condenser, operate with efficiencies mid-way between air and water cooled methods. The TrilliumSeries Condenser uses water only on the hottest days to maintain condensing temperatures, attaining up to 38% energy cost savings compared to air cooled technology. With its low water use profile, the TrilliumSeries Condenser is a proven solution when water is scarce. Furthermore, to address regulatory concerns associated with traditional refrigerants, the unique adiabatic design of the TrilliumSeries Condenser empowers the design and application of transcritical CO₂ refrigeration systems to virtually all climate zones worldwide. “We’re excited to lead the industry with sustainable solutions that allow for more natural refrigerants,” Fetzer added.

Visit www.baltimoreaircoil.com

Bitzer Approves HFO Refrigerants for Screw Compressors

Following an extensive qualification program, compressor specialist BITZER has announced approval of the R1234yf and R1234ze(E) HFO refrigerants for its CSH and CSW screw compressors. The two alternatives to R134a have a global warming potential (GWP) of under ten, while the GWP of R134a is around 1,400. With a GWP of about 600 each, the HFO/HFC blends R513A and R450A are also approved for the CSH and CSW series. Unlike the pure HFO refrigerants, they’re nonflammable.

The requirements stipulated by the EU’s F-gas Regulation no. 517/2014 also represent a huge challenge for manufacturers of refrigeration compressors. In order to meet the phase-down objectives, alternative refrigerants such as hydrofluoroolefins (HFOs) will have to be used in the future. The volumetric refrigerating capacity and pressure levels of R1234yf are comparable with those of R134a, while the capacity figures and pressure levels of R1234ze(E) are around 20 to 25% lower. BITZER subjected the R1234yf and R1234ze(E) refrigerants in this group to intensive testing, and the compressors performed well with both in all of the tests and laboratory experiments. The tested compressors achieved nearly identical isentropic efficiency values with R1234yf and R1234ze(E) as with R134a. Due to differences in the thermodynamic properties, the COP measurement results are in some cases slightly lower.

Both of the HFOs are suitable for air conditioning and medium temperature applications in particular, as well as for heat pumps. There’s often a degree of uncertainty regarding flammability. In safety data sheets,
R1234ze(E) is listed as nonflammable, though this only applies to transport and storage. When used as a refrigerant, a higher reference temperature of 60°C is applied in flammability tests. At this temperature, R1234ze(E) is flammable and therefore assigned to the A2L safety group, just like R1234yf. For this reason, a risk assessment in accordance with the ATEX Directive is required for systems with both refrigerants – with potential consequences in the system design. BITZER compressors for HFO refrigerant fulfill the relevant requirements, making additional evaluation unnecessary.

HFO/HFC blends such as R513A and R450A, on the other hand, are nonflammable and therefore classified in the A1 safety group. Using them requires nothing more than a conventional risk assessment in accordance with the Machinery Directive. However, the substitutes R513A and R450A have a GWP of around 600.

After evaluating all of the results, BITZER has announced approval of the HFO refrigerants R1234yf and R1234ze(E) and the HFO/HFC blends for CSH and CSW compact screw compressors. These tried-and-tested products can be operated with the standard ester oil charge (Y-model) with HFO refrigerants in the documented applications.

Detailed technical descriptions with performance data and application limits can be found in the SP-171-3 (CSH) and SP-172-6 (CSW) documentation. The corresponding data will be provided in the BITZER software in due time.

**CSH and CSW: high energy efficiency**

The universal CSH and CSW compact screw compressors can also be used with the economizer circuit to further increase refrigerating capacity and efficiency. They’re fitted with dual capacity control and can be adjusted infinitely or according to scale. The level of energy efficiency is a benchmark in this compressor technology in both full-load and part-load operation.

CSH compressors demonstrate their strength particularly in air-cooled liquid chillers for comfort air conditioning and in heat pumps. The GSW series is suitable for use in liquid chillers operated at low condensing temperatures. The compressors are used in systems with water-cooled condensers, process cooling and systems with air-cooled condensers operating under moderate climatic conditions.

*Visit www.bitzer.de*

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ELIMINATING CATALYST COOL DOWN as Critical Path in a Turnaround

By Barney Smith, Turnaround Manager, Aggreko

Introduction

As with most major process plants, refineries and petrochemical plants periodically need to shut down the entire plant or major portions of it for major maintenance activities. These time periods are referred to as ‘turnarounds’ and are time periods of intense activity. Once the plant shuts down, a considerable amount of money is being spent without any revenue being generated.

Catalyst Cool-Down: The Common Turnaround Bottleneck

Many refinery and petrochemical processes, such as hydrotreaters, hydrocrackers, and reformers, contain catalytic materials in their reaction beds. It could be just one bed in one vessel, multiple beds in one vessel as shown in the adjacent hydrocracker reactor process flow diagram, or multiple beds in multiple reactors. Operating temperatures in these processes can be very high. Once a plant begins an initial maintenance shutdown, all of this catalyst (often hundreds of thousands or millions of pounds) must be cooled from these high operating temperatures down to near ambient temperatures. Given the amount of catalyst and reactor metal mass, this takes time and is very often the bottleneck, or is on the ‘critical path’, for the entire turnaround.

“Once a plant begins an initial maintenance shutdown, all of this catalyst (often hundreds of thousands or millions of pounds) must be cooled from these high operating temperatures down to near ambient temperatures.”

— Barney Smith, Turnaround Manager, Aggreko
Normal Cool-Down Method Takes Days and Consumes Large Volumes of Liquid Nitrogen

The normal cool down process generally consists of two distinct phases. During the first phase, feed is blocked in and the furnace is shut down. The recycle gas compressor circulates hydrogen-rich gas through the feed/effluent exchanger (if there is a bypass around the exchanger then it should be routed through the bypass), through the furnace (though the furnace is not operating), and into the reaction vessel where the gas picks up heat from the hot catalyst bed. The hydrogen gas is then cooled in fin-fans and a cold water exchanger before entering the high pressure low temperature separator (for this PFD; other units may have high pressure, high temperature separators and the cooling is only done on the gas stream and/or there may be low pressure low or high temperature separators where the gas is separated) before repeating the loop. This approach can be used until the catalyst temperature reaches a certain point – normally about 150 – 200 deg F. After that point, the rate at which heat is dissipated reaches a point of diminishing returns. However, it is still too warm for safe vessel entry.

Traditionally, the second phase requires purchasing liquid nitrogen with a vaporizer/feed system and injecting it ‘once through’ into the reactor system, with the nitrogen normally exiting to the flare system. Given the very large mass of the reactor metal and catalyst to be cooled, this operation generally takes several days.

Not only is this expensive due to the cost of purchasing liquid nitrogen, it becomes a logistic nightmare since it requires a constant parade of liquid nitrogen road tanker trucks coming in and out of the refinery. This is especially problematic during a turnaround when minimizing traffic density in the refinery is an important consideration.

In addition, this extra nitrogen is ordinarily relieved via the flare system, which lowers the calorific value of the flare gas. This can cause problems since the calorific value of the flare gas is subject to regulatory limits designed to prevent snuffing out the flare. If too much nitrogen is used, supplemental fuel gas, such as LPG, must be added and subsequently burned in the flare just to keep its calorific value within regulatory limits. Obviously, using LPG in this manner is economically wasteful since it could be recovered and sold. Another problem with nitrogen is that it consumes flare capacity whose primary purpose is to be available for emergencies and other process uses.

While relieving via the flare is the normal route, there are some refiners that relieve the nitrogen via the fuel gas system. Obviously, this creates a whole other set of problems since nitrogen doesn’t combust and just takes up space in the fuel gas system. Worse yet, it lowers the calorific value of fuel gas causing significant combustion problems in refinery furnaces. There are even other refiners that relieve the nitrogen straight to the atmosphere causing environmental problems.

Another potential strike against liquid nitrogen is there are certain situations where injecting liquid nitrogen can cause metallurgical problems due to how cold the nitrogen is when entering the vessel.

For all these reasons, refiners and petrochemical operators are open to other ideas on how to safely speed up the second portion of the catalyst cool-down process without the costs or problems inherent with using purchased liquid nitrogen.
**An Improved Solution — Cools Down Faster, Without the Need for Nitrogen**

In order to overcome these problems during the Phase 2 cool down period, Aggreko has created an innovative, practical solution circulating coolant through an Aggreko-provided, closed loop, chiller system which cools down the gas leaving the recycle gas compressor discharge in an Aggreko-provided heat exchanger. This arrangement can cool down the catalyst much faster than if the plant had used liquefied nitrogen. This eliminates the need for costly nitrogen.

As the above diagram illustrates, the client’s equipment is denoted by the red or rose color whereas Aggreko-supplied equipment is shown in blue.

The following describes a typical process flow arrangement for the catalyst cooling solution, though there are likely many different alternatives depending on the actual client process equipment configuration.

Control valves for beds 1 and 2 are removed. The control valve for bed 3 remains intact, but the valves upstream and downstream of the control valve along with the bypass are all closed.

For bed 1, the bypass and valve upstream of the control valve are closed. However, the valve downstream of the control is open and new piping is installed and routed from the Aggreko heat exchanger outlet to the inlet of the valve downstream of the bed 1 control valve.

On the client side, it is more advantageous to route material leaving the reactor around the feed/effluent exchanger. That's because any additional heat picked up in this exchanger will need to be relieved via the Aggreko exchanger slowing the cooling process. After the feed/effluent exchanger material will tend proceed through the furnace. Since the furnace will not be providing any heat it just acts as a wide spot in the line.

The net effect of all these changes is to route gas from the recycle gas compressor discharge to the heat exchanger so that the coldest gas enters at the top of the reactor. It's important to understand that the heat exchanger is placed downstream of the recycle gas compressor so that it cools the reactor gas further, but also to remove the heat of compression added during the compression cycle.

The black piping lines in the diagram are the hard piping that already exists for the client’s equipment. On the other hand, connections shown in red are stainless steel braided connections for the cooling water circuit.

The surge vessel is provided to enable gas separation and venting in case of unexpected gas leaks into the cooling water from the recycle gas side of the heat exchanger. Water from the bottom of the surge enters the circulating pump (spare is provided) suction, which pumps it back to the refrigerated chiller, thus closing the loop.

System operation is straightforward. Chilled water flows within a closed loop system leaving the refrigerated chiller outlet at approximately 40˚F and entering the cold side of the heat exchanger. Gas from the discharge of the recycle gas compressor flows to the warm (shell) side of the exchanger. Cooling water is warmed to about 55˚F and sent to the process surge vessel.

For bed 2, the bypass and valve downstream of the control valve are closed. However, the valve upstream of the control is open and new piping is installed and routed to the Aggreko heat exchanger inlet.

**System Operation is straightforward.** Chilled water flows within a closed loop system leaving the refrigerated chiller outlet at approximately 40˚F and entering the cold side of the heat exchanger. Gas from the discharge of the recycle gas compressor flows to the warm (shell) side of the exchanger. Cooling water is warmed to about 55˚F and sent to the process surge vessel.

The design temperature of the recycle gas inlet temperature to the heat exchanger is 200°F with the desired final reactor temperature of 90˚F or below. Since the design temperature of the coolant inlet temperature is 40˚F, the lowest temperature achievable is 70˚F. However, it would approach temperatures below 90˚F asymptotically.

"The net effect of all these changes is to route gas from the recycle gas compressor discharge to the heat exchanger so that the coldest gas enters at the top of the reactor."  

— Barney Smith, Turnaround Manager, Aggreko
Model Estimates Cool-Down Time

The typical time to cool the reactor catalyst down from 200°F to less than 100°F using the Aggreko solution without sending any gas to the flare is between 12-14 hours. However, Aggreko has built a catalyst cooling correlation model based on the amount of catalyst mass, reactor mass, number of catalyst beds, and other factors that will allow a client to better estimate this time saving, a client more accurately determine the ROI of this approach for their particular plant/unit.

Benefits of Quicker Cool-Down

The good news is that the Aggreko phase 2 cool down solution will allow entry to the reactor vessel much quicker. This may permit the plant to move this vessel off the ‘critical path’ and allow the plant the ability to get the units restarted in a shorter time period. The quantifiable benefits of being able to reduce the time to cool down catalyst and gain vessel entry more quickly during a turnaround can vary significantly depending on:

- If the vessel is on the ‘critical path’;
- How many days are saved by moving it off the ‘critical path’;
- How many units in the plant are down for maintenance;
- Total marginal value for getting the plant back online for the affected units;
- Total cost of nitrogen saved;
- Total cost of LPG saved

On the high side, if moving the vessel off the critical path allows an entire refinery to be back online 2 days sooner, then a 150,000 BPD per day refinery with a $25 refinery feed marginal value could net $7,500,000 without ever considering the nitrogen and other logistical savings.

However, even if only the unit itself benefits from this change, the savings can still be very significant. For a 30,000 BPD hydrotreater with a $10/bbl marginal value, if the Aggreko solution can shave 2 days off the total turnaround time, the savings would total $600,000.
ELIMINATING CATALYST COOL DOWN AS CRITICAL PATH IN A TURNAROUND

Even if this approach does not affect the critical path, the refiner will be able to save the cost of the nitrogen and any costs associated with transporting it to the plant site. In addition, there will be no need for all those trucks to enter the facility during a time when there is a high degree of activity within the plant. The fewer people and activities required during a turnaround is always advantageous from a safety standpoint. Another possible tangible benefit is any LPG or other fuel saved that was used to maintain the flare gas within calorific ranges.

Aside from explicit quantifiable benefits, they may be other ways to use the time that is saved that is not easy to quantify. For example, a quicker cool down time may allow a refiner to:

- Recoup time or prevent possible schedule slippage that seems to inevitably occur during a turnaround;
- Get more work done on this unit, for example a small capital project, than what would otherwise have been previously possible.

Summary

During a turnaround refiners must cool the catalyst in hydrotreaters, hydrocrackers, and reformers from the unit’s normal high operating temperatures to near ambient temperatures in two separate steps. The first step uses the equipment in the unit to cool the catalyst to approximately 200˚F. The second step has often used liquid N₂, but faces numerous disadvantages. For this reason, Aggreko’s has developed a patented process that can typically accelerate catalyst cooling from 200˚F to under 100˚F within 12-24 hours. The process takes recycle gas compressor discharge and cools the stream against a water/glycol solution in a heat exchanger positioned downstream of the recycle gas compressor. The recirculated solution is then cooled in an Aggreko-provided mechanical chiller. Accelerating catalyst cool down will allow entry to the reactor vessel much quicker, possibly permitting the plant to move this vessel off the ‘critical path’, allowing the plant to restart the units faster. Alternatively, if this unit is not on the critical path, this unique cooling arrangement can still allow the plant to implement a capital project or perform other work on the unit that might not otherwise have been possible.

About Aggreko

The technology described in this white paper was developed by the Aggreko’s Process Services (APS) division. APS supports Aggreko’s Refining and Petrochemical division which has provided rental equipment solutions to the industry for over 25 years. APS is the rental equipment industry’s only specialized, rapid response team of elite, licensed process engineers that provide complete, customized packaged engineering solutions for turnaround, emergency, process improvement or debottlenecking purposes, such as temperature control, electric distribution, compressed air, etc. Projects are implemented on very short schedules - days or weeks - and will increase throughput, reduce turnaround times and costs providing benefit to cost ratios of between 5:1-30:1.

Author Biography

Barney Smith is the Turnaround Services Manager for Aggreko. He specializes in working with plants on complex engineered solutions related to process bottlenecks and seasonal cooling limitations. Prior to Aggreko, Barney held several sales and operations management roles in the rental utility industry. Barney has a B.S. in business administration from the University of Louisiana – Lafayette and currently resides in Pearland, Texas with his family.

For more information visit: us.aggreko.com or call: 855.245.4601.

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“Aggreko’s has developed a patented process that can typically accelerate catalyst cooling from 200˚F to under 100˚F within 12-24 hours.”

— Barney Smith, Turnaround Manager, Aggreko
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The 2016 International Air-Conditioning, Heating, Refrigerating Exposition (AHR Expo), held at the Orange County Convention Center in Orlando, Fla., welcomed 60,926 registered attendees. Thousands of contractors and engineers, OEMs, distributors and plant managers, from all facets of the global HVACR industry, converged at AHR Expo making it the world’s largest HVACR marketplace. In total 469,540 square feet, of exhibit space, was occupied by 2,063 exhibitors.

I donned my roving-reporter hat and rather randomly visited as many booths as I could. Due to article space and visit-time constraints, I must apologize in advance to those not mentioned here and also for the brevity of my comments.

“We continue to support our chiller OEM’s with significant commitments to inventory in Buffalo while our in-factory process cooling applications continue to grow.”

— John Medeiros, Managing Director, MTA U.S.A.

This year’s 18,254 exhibitor personnel addressed 42,672 visitors, based on a preliminary attendance count by the show’s management company, International Exposition Company.

▶ The 2016 International Air-Conditioning, Heating, Refrigerating Exposition (AHR Expo), held at the Orange County Convention Center in Orlando, Fla., welcomed 60,926 registered attendees. Thousands of contractors and engineers, OEMs, distributors and plant managers, from all facets of the global HVACR industry, converged at AHR Expo making it the world’s largest HVACR marketplace. In total 469,540 square feet, of exhibit space, was occupied by 2,063 exhibitors.

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**Chiller Technology**

I had the distinct privilege of meeting the Chairman and CEO of the **Smarrdt Chiller Group**, Roger Richmond-Smith. He’s an Australian entrepreneur who can intermix true stories of pioneering engineering with magnetic bearings and oil-free centrifugal compressors (which evolved into the Turbocore refrigeration compressor technology) together with adventure tales of relocating 20 Australian families (+ one unhappy parrot) to Quebec with dreams of conquering North America. Today, the Smardt Chiller Group is a leading global chiller manufacturer laying claim to possessing the largest installed base of oil-free centrifugal chillers (more than 4000 units). Smardt operates significant manufacturing operations in upstate New York, Canada, China and Germany.

**Motivair** had an impressive booth featuring a huge MLC-SC air-cooled scroll chiller. General Manager Rich Whitmore walked me through its R-410A scroll compressors, condenser fans driven by electronically commutated variable speed motors, optional free-cooling and shell and tube evaporators featuring two independent refrigeration circuits. Featuring models ranging from 100-285 tons, an optional third refrigeration circuit is possible. Featuring a multi-character LCD display, PLC control is provided by the PCO5 control system.

**Multistack** Executive Vice President, Ralph Breisch, took a few minutes to review “what’s new in 2016” from this Sparta, Wisconsin based chiller manufacturer. This included new ASC air-cooled chillers ranging from 20-195 ton models with two refrigeration circuits per chiller, VME II pump skids, MagLev VTT™ refrigeration compressors and the MultiPRO™ Central Plant Controller. This company has a significant investment into the “systems” philosophy of helping a building/plant manage thermal requirements – while reducing waste. Their VME (Virtual Moveable Endcap) II pump skids provide full-load, partial-load efficiency (and can integrate free-cooling during the winter) for simultaneous and variable heating and cooling. Available from 30 to 1320 tons, these pre-engineered solutions represent Multistack’s focus on recapturing the heat rejected by chillers and reducing boiler natural gas consumption.
The Arctic Chiller Group manufactures a wide range of modular water-cooled chillers (up to 1600 tons) and air-cooled chillers (up to 450 tons) out of manufacturing facilities in Canada, South Carolina and Italy. Their Newberry, South Carolina plant manufactures and stocks critical-duty medical and process chillers. Their booth was incredibly busy yet their VP of Sales and Marketing, Mark Rogan, generously took a few minutes to explain their success serving both commercial HVAC and industrial process applications, “Our engineering expertise with scroll, screw and oil-free magnetic bearing refrigeration compressors allows us to offer an incredibly broad range of options including clean-while-running-strainers, integrated automatic free-cooling and heat recovery for simultaneous heating and cooling.”

MTA had a nice booth exhibiting “plug and play” packaged chillers and free-cooling solutions. John Medeiros, MTA U.S.A. Managing Director said, “We continue to support our chiller OEM’s with significant commitments to inventory in Buffalo while our in-factory process cooling applications continue to grow.” The booth featured an ARIES partial-mode, free-cooling chiller system able to automate and integrate the benefits of the free-cooling mode when ambient temperatures are in a range up to 18°F lower than the required fluid outlet temperature. Under these conditions, all the refrigeration compressors, in the condensing section of the chiller, are switched OFF.

The average data center uses approximately 4 million gallons of cooling water per megawatt per year. Emerson Network Power announced the deployment of the Liebert® DSE pumped refrigerant economization system has saved over 1.4 billion gallons of water (over the past 36 months) in North American data center installations. The Liebert DSE system is the first pumped refrigerant economization system for use in data centers, and uses no water and introduces no outside air into the data center. A recent Emerson survey of mechanical engineers showed that 55 percent expect pumped refrigerant economization to be the number one technology replacing chilled water systems over the next five years.
**Fricon USA** is based outside of Atlanta and specializes in ice-makers, air-cooled chillers, modular chillers, industrial condensing units and industrial condensing units for food processing plants, slaughterhouses, ice plants, blast freezers, cold rooms and food storage/distribution facilities. They manufacture both an Industrial and a Commercial line-up of products featuring Bitzer scroll refrigeration compressors. Interestingly, they’ve long operated an “export-only” business but President Fernando Escuela told me they’ve just received UL Certification and are starting to focus on the U.S. market.

**EcoChillers** is a Mexico-based chiller manufacturer with sales offices in Miami and Laredo, Texas. Process Engineer Pedro Machain told me of an interesting installation in Queretaro where a metal stamper asked for a 500 ton chiller. They did a system assessment and sold a 150 ton chiller with a dry cooler! They manufacture a broad range of Ecogreen® 7.5 – 256 ton chillers with different screw, water—cooled and dry/free cooling chiller models. Newly introduced was an ECT chiller featuring scroll refrigeration compressor technology.

### Refrigeration Compressors and Measurement

David Hules, from Emerson Climate Technologies, presented the second generation of its Copeland Scroll™ variable speed ZPV2 refrigeration compressor and EV2 motor control drive for light commercial applications. The ZPV2 features intermediate discharge valves to boost efficiency, optimized scroll elements for variable speed performance, positive displacement oil pump for enhanced reliability in low speed operation and brushless permanent magnet motor technology for maximum efficiency.

**Vaisala** manufactures a full range of humidity instruments for the HVAC industry. Steve Santoro walked me through their range of INTERCAP® wall-mount, duct-mount and outdoor, humidity and temperature transmitters. They also manufacture a range of carbon dioxide instruments consisting of duct and wall mount transmitters equipped with their proprietary CARBOCAP® sensor.
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**Cooling Towers**

I enjoyed meeting the team at New Jersey based Delta Cooling Towers. They manufacture non-corroding, engineered-plastic (HDPE) cooling towers backed by a 20-year shell warranty, which will not rust, corrode, or require the downtime for service common with traditional metallic towers. President John Flaherty said, “We designed our first engineered plastic cooling tower in 1971 and are proud to offer an industry-leading 20-year warranty on the tower casing.” The company also manufactures packaged cooling systems and air stripping equipment.

REYMSA literature stakes a claim as the leader in high-grade “all fiberglass” cooling towers. Edgar Alanis explained they are constructed of high-grade FRP (Fiberglass Reinforced Polyester) and are corrosion resistant. They have a 30+ year life expectancy and carry a 15-year warranty for the casing and structure. Bearing the “CTI Certified” stamp, the thermal performance of REYMSA cooling towers is certified by the Cooling Technology Institute. The RT and RTM models feature direct-drives while the RTG and RTGM models are gear-driven systems. All motors are severe and marine-duty premium efficient motors (featuring the Inpro/Seal VGX Bearing isolator) with 5-year warranties.

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While the chiller is the heart of a chilled water system, its support system of components and controls are equally critical to maintain and manage to ensure the highest system efficiency levels are attained.

Emphasis is often placed on the chiller since it is the most visible and typically the highest energy element of a chilled water system. Yet, if you look beyond the flanges, there’s an opportunity to improve delivery of chilled water to the airside or process loads and maximize system efficiency.

In large building and facilities, chilled water-cooling systems can yield many advantages, including refrigerant and maintenance containment, energy efficiency, and low installed cost. Those advantages can also be magnified when building owners work with a partner to maintain the full system over the lifetime of the system to reap additional rewards. The full system means that we need to look beyond the chiller itself to other key components such as chilled and condenser water pumps, cooling towers, heat exchangers, and hydronic specialties including water pressure regulators, air separators, and chemical feed pots. Controls are also critical to the system because they operate water valves, control set points and schedule equipment.

Maintenance issues for the larger chilled water system, including those at the component level,
may indeed originate at the chiller. Yet, real detective work may be necessary to identify the root cause since trouble may start somewhere in the ancillary components of the chilled water system.

**Water Pumps**

Chilled water pumps deliver the cold water to the building/process loads and then carry the heated water back to the chiller for re-cooling. Condenser water pumps circulate the cooling water between the chiller water cooled condenser and cooling tower (or other heat rejection device). Pumps not sequencing properly or low flow conditions may fault a chiller and not be understood until operation is restored.

Common centrifugal impeller pump types include end-suction and split case construction. Service considerations are pump and motor bearing lubrication and water seal cooling on larger pumps.

Motor-pump shaft alignment is important and should be checked periodically as heavy piping and supports may shift over time.

Providing positive suction pressure is important to prevent capitation and air erosion. Pressure regulator stations maintain water loop pressure and air separators remove unwanted air from the chilled water.

**Cooling towers**

Condenser water transfers the unwanted heat load removed by the chiller and the chiller’s compressor work (heat of compression) to the cooling towers. These towers come in several common types: forced or induced draft and counterflow or crossflow. Typically, towers are constructed of steel, fiber-glass reinforced plastic (FRP), wood or concrete. Service requirements across all types of cooling towers are consistent. Fan motors, gear or belt drives, and water make-up float assemblies all require routine maintenance and inspection. Tower basins as well as fill and distribution pans all need periodic cleaning.

**Airside**

This is where the heat load is transferred to the chilled water loop via a chilled water coil. Coils are part of an air handler unit, which also contains air filters, fans, mixing boxes/dampers, and other air handling devices. Coils are commonly constructed of copper tubes and aluminum fins requiring routine service such as air filter replacement and fin cleaning. Drain pans and lines also need to be cleaned.

“In large building and facilities, chilled water-cooling systems can yield many advantages, including refrigerant and maintenance containment, energy efficiency, and low installed cost.”

— Joe Leichner, PE CMVP, Director of operations, owner sales, Daikin Applied Americas
EVALUATING CHILLED WATER COOLING SYSTEM COMPONENTS

of accumulated biological growth and dirt to sustain proper indoor air quality. Dirty coils can significantly curtail efficient heat transfer and hike energy use since operators typically must lower chilled water temperatures to overcome the reduction in heat transfer.

Hydronic Specialties
Pressure water feed and relief stations should be checked periodically to ensure proper water loop pressure. Pressure that’s too low may prevent circulation to high level air handler coils or pump cavitation. While they

Dailin
Chiller Economic Energy Analysis

The first steps to operating a highly efficient chilled water system is understanding what’s installed.

Coils are commonly constructed of copper tubes and aluminum fins requiring routine service such as air filter replacement and fin cleaning.
require minimal attention, a regular check of expansion tanks and air separators is wise. Chemical feed pots are used to introduce chemicals or glycol to closed loop systems. Heat exchangers are used to isolate different loops and are used in economizer systems. Larger heat exchangers are field cleanable, yet that can be a time-consuming task due to the complexity of the procedure.

**Water Treatment**

Water loops require treatment for the prevention and control of corrosion, scale presence, and biological growth. Closed chilled water system loops are not exposed to the atmosphere, but still need inhibitors to control corrosion. Open cooling tower systems are more demanding. Cooling towers act like a large air washer and require regular maintenance to combat corrosion problems. Many water treatment approaches are successfully used in systems today, including chemical, magnetic, and ozone types.

Fouled water and scaled pipes inhibit heat transfer at the chiller and cooling coils. A miscue in water treatment can quickly damage the chiller’s tubes – a substantial and major performance issue. Therefore, regular eddy current testing of tubes is a good practice, along with consistent, effective water treatment. Because cooling towers evaporate large amounts of water with some drift to the atmosphere, control of biological matter is also an important health issue. Several antimicrobial growth products are available that will help minimize biological growth in the cooling tower basin.

**Controls**

New digital-based controls are fairly low maintenance other than occasional software updates and calibration. Older pneumatic systems employ air compressor/driers, which require specific routine service. Moisture in a pneumatic system can be detrimental to proper operation causing expensive clean-up costs. Dampers and water control valves also should be checked for operation and lubed where necessary. Controlling the chiller plant pump sequence, air handler scheduling and exhaust fan operation can all impact chiller operation and performance. Chilled water temperature pull-down rates need to be slow and steady. Fast temperature and/or flow changes can cause erratic and inefficient chiller operation. On variable flow systems, minimum flows should be confirmed.

**Summary**

The complexity of service tasks and frequency varies for all equipment and components; the manufacturers’ operation and maintenance manuals should be consulted for specific guidance. To sustain efficient and reliable operation, a building owner who relies on a chilled water system would benefit from a professional service technician’s advice and eye. Developing and executing a service schedule plan will help minimize unscheduled and costly shutdowns, while safeguarding the investment in equipment.

The extensive support system can often impact the chiller’s operation and are not always immediately apparent without digging deeper. The first steps to operating a highly efficient chilled water system is understanding what’s installed, how it operates, and what the right service plan approach is to optimize performance over the full life of the equipment. Proper commissioning and establishing an energy baseline can also help in noting any service trends that require attention.

For more information, visit www.daikinapplied.com

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“Water loops require treatment for the prevention and control of corrosion, scale presence, and biological growth. Closed chilled water system loops are not exposed to the atmosphere, but still need inhibitors to control corrosion.”

— Joe Leichner, PE CMVP, Director of operations, owner sales, Daikin Applied Americas
Anecdotal reports from users of Tower Tech cooling towers across the U.S. have indicated the Tower Tech design provides substantial savings to the customer both in terms of lower chemical treatment requirements and substantial water savings. There are a number of mechanisms by which the Tower Tech design facilitates efficient, lower cost water treatment and usage. A few are described in this paper.

Impact of Enclosed Flow-Thru Basin Design & Absence of Side Louvers

“Outside” environmental factors such as wind blown sediment, process contaminants, pollens, etc. have less opportunity to gain entrance into the Tower Tech tower interior. The enclosed basin design and absence of side air louvers diminishes the likelihood of wind-blown solids intrusion. High solids loads can lead to piping and heat exchanger fouling and under deposit corrosion. Furthermore interactive effects between solids and biofilm are minimized. Mechanical methods are able to remove particulates 10 um (micron) and larger, however, little can be done through filtration or separation techniques to handle the majority of particulates under 10 um in size.

“Environmental factors such as wind blown sediment, process contaminants, pollens, etc. have less opportunity to gain entrance into the Tower Tech tower interior.”

— Dr. S. Curtis, Ph.D.
Higher solids loads in the tower system can dramatically impact the system’s oxidizer demand, therefore more chlorine is needed to maintain a sufficiently high level of residual.

Dust particulates under 10 um in size can act as seed nuclei for crystal formation - the first step in the scaling process. The Tower Tech design, as described above, reduces the entrainment of small size dust particulates thereby addressing one vehicle for nucleation.

Dust particulates of all sizes carry electrical charges. Scale inhibitor polymers and phosphonates can bind to the dust particulates and thus become unavailable to coat newly emerging crystals. Adsorption of the inhibitor onto new crystal surfaces is necessary for retarding continued growth via steric hindrance. The Tower Tech tower design prevents unnecessary “wastage” of inhibitor.

Impact of Flow-Thru Basin Design

The Tower Tech “Flow-Thru Basin” design provides 5-7 fps flow velocities through the tower basin. Flow rate is a key determining factor in the formation, maintenance and loosening of biofilm layers. High flow rates placed perpendicular to the diffusion of nutrients into biofilm will impair the transport of nutrients and removal of metabolic byproducts. This will drastically impact the ability to sustain biofilm “life”. Furthermore high velocity water flow will assist in sloughing off adhering cells preventing them from forming the critical glycocalyx layer necessary for adhesion and biofilm protection. Experts suggest that a flow rate of less than 3 fps is necessary to allow for reasonable biofilm growth. In fact instructions for operating “biofilm monitors” require that velocity settings through the monitor not exceed ~3 fps. The Tower Tech design limits biofilm growth and with it ensuing scale adhesion and under deposit corrosion.

Impact of Reduced System Volume

System volume may be positively impacted in installations using the Tower Tech design. In conventionally designed towers for the process industries the basin capacity can be estimated to be 7-10 times the recirculation rate. With Tower Tech’s “Flow-Thru (elevated) Basin” design the basin capacity required is only 1.75-2 times the recirculation rate. Likewise in conventionally designed towers for the HVAC market the basin capacity can be estimated to be 0.7 - 1.3 times the recirculation rate. With Tower Tech’s “Flow-Thru” basin design the basin capacity required is only ~0.2-0.3 times the recirculation rate. This results in significant savings with regards to total amount of water requiring biocidal treatment.

Reducing the System Volume can dramatically affect the Holding Time Index (HTI) of the cooling system. The Holding Time Index is the time required to remove 50% of the water from the cooling system. The Holding Time Index of a process cooling system using a conventionally designed 12,000 GPM tower can be estimated to be 15 hours. Using the Tower Tech design the HTI can be decreased...
TOWER TECH COOLING TOWER DESIGNS REDUCE WATER CONSUMPTION AND TREATMENT

The Holding Time Index of an HVAC cooling system using a conventionally designed 1,200 GPM tower can be estimated to be 5 hours. Using the Tower Tech design, the HTI can be decreased to only 2 hours. Increasing the holding time has a direct effect on crystal kinetics of growth. The longer the holding time, the more prevalent larger scale crystals will become. This is due to the fact that larger scale crystals grow preferentially faster to small sized scale crystals. It is the larger scale crystals that reach a density sufficient to begin to settle out on tower and system surfaces leading to scale film formation.

Reducing the Holding Time Index can also be considered an effective way to reduce the planktonic (free-living or unattached bacterial flora) cell population within the cooling tower system. Extrapolating from the study of bacterial populations in chemostats (bacterial cell cultures) - increasing the turnover of a system (inverse of HTI) can lead to washout of the bacterial population. Wash out of course will only occur if no new cells are seeded into the system. In the Tower Tech tower due to the more closed in design there is less opportunity for bacterially laden dust particulates to enter into the system. Coupled with the higher turnover rates, the Tower Tech tower can drastically curtail planktonic population growth.

Impact of Enclosed Flow-Thru Basin Design & Ensuing Absence of Sunlight

Tower Tech’s closed in basin design eliminates the entrance of sunlight into the tower water virtually eliminating the ability of algae to proliferate. Algae are aerobic photosynthetic organisms. Photosynthesis is the process by which algae derive their metabolic energy. Given sufficient light and nutrients algae can reproduce rapidly or “bloom” in a conventional tower environment. Furthermore algae can themselves serve as a source of organic nutrients for bacterial life forms to thrive in the tower water. Controlling algae can have a direct impact on controlling bacterial cell populations and in turn biofilms.

Based on System Volume differences and absence of a need for algaecide a Tower Tech HVAC tower at 1,800 GPM will have an estimated biocide cost of $3,958 per annum whereas a conventionally designed tower will require $5,959 per annum. This delivers a ~33% savings on biocides per annum. In the Process Industry a 12,000 GPM Tower Tech cooling tower will have an estimated biocide cost of $29,755 per annum whereas a conventionally designed tower will require

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“Tower Tech’s closed in basin design eliminates the entrance of sunlight into the tower water virtually eliminating the ability of algae to proliferate.”

— Dr. S. Curtis, Ph.D.
$37,397 per annum. This delivers an ~20% savings on biocides per annum.

**Ability to Operate at Higher Cycles of Concentration**

Early reports indicate that the Tower Tech design can allow operators to achieve on average COC’s 1-2² greater than conventionally designed towers. Based on the ability to operate at higher COC’s only a Tower Tech HVAC tower at 1,800 GPM will have an estimated chemicals cost ⁶ of $12,473 per annum whereas a conventionally designed tower will require $17,642 per annum. Costs are even more dramatic in the Process Industry where a 12,000 GPM Tower Tech cooling tower will have an estimated chemicals cost ⁷ of $156,692 per annum whereas a conventionally designed tower will require $230,444 per annum.

Water and sewer costs can also be reduced due to the ability of the Tower Tech tower to operate at higher COC. For example, using the Tower Tech HVAC tower at 1,800 GPM would result in total water and sewer cost ⁶ of $15,782 whereas a conventionally designed tower would result in a total water and sewer cost of $19,235. This results in an 18% savings on total water costs. A 12,000 GPM Tower Tech process tower would result in a total water and sewer cost of $336,384 whereas a conventionally designed tower would result in a total water and sewer cost of $409,968. This results in an 18% savings on total water costs.

**About Tower Tech:**

Tower Tech, Inc., based in Oklahoma City, USA manufactures innovative modular cooling towers designed to reduce installation time and costs, environmental impact, operating costs, and tower maintenance. Design features include: variable flow technology; low Legionella risk; TSE and sea water friendly operation; non-corrosive construction; built-in redundancy; and low sand/dust entrapment.

Tower Tech’s products are used worldwide for comfort cooling, industrial processes, and power generation. Tower Tech’s revolutionary cooling towers have been recognized by environmental advocacy groups for their ability to conserve energy and water.

For more information, visit www.towertechinc.com or contact Dan Coday, Sales Manager, Tower Tech, Inc. at email: dcoday@towertechinc.com or tel: 405-979-2141

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**ENDNOTES**

1 Assumes 20°F delta T, 4 COC’s and a 1% evaporation rate.
2 Assumes 10°F delta T, 4 COC’s and a 1% evaporation rate.
3 Based on both towers operating at 3 COC’s, 20 hrs/day, 8 months/year, maintaining a 10°F delta T and 1% evaporation rate. Does not consider the fact that the Tower Tech tower would allow cycling at a higher level hence a further reduction in biocide requirements.
4 Based on both towers operating at 3 COC’s, 24 hrs/day, 365 days/year, maintaining a 20°F delta T and 1% evaporation rate. Does not consider the fact that the Tower Tech tower would allow cycling at a higher level hence a further reduction in biocide requirements.
5 Gain of 1 COC is possible in installations operating at 3-4 using conventional tower designs. Whereas a gain of 2 COC is possible in installations operating at 2-3 COC’s using conventional tower designs.
6 Based on the Tower Tech tower achieving 4 COC and conventional design only reaching 3 COC, operation 20 hrs/day, 8 months/year, maintaining a 10°F delta T and 1% evaporation rate.
7 Based on the Tower Tech tower achieving 4 COC and the conventional design only reaching 3 COC, operation 24 hrs/day, 365 days/year, maintaining a 20°F delta T and 1% evaporation rate.
8 Example assumes a water cost of $1.50/1000 gal and a sewer cost of $2.00/1000 gal. Also takes into account a sewer cost deduction (rebate) for evaporation.
9 Information presented is for illustrative purposes only. Values chosen are based on a general U.S. average for approximate cost of chemicals and water (purchase and disposal). Furthermore, COC’s chosen are based a moderately hard to hard water analysis.
CHILLER TECHNOLOGY AT PROCESS EXPO

Process Expo 2015 was held at the McCormick Place Convention Center in Chicago. Co-located with InterBev Process and the International Dairy Show, this event draws significant attendance from the food and beverage industries. Show producer, the Food Processing Suppliers Association (FPSA), announced final record attendance numbers with a total combined registration of 19,670 people and a total of 914 exhibiting companies occupying 334,820 net square feet.

Dimplex Thermal Solutions

Dimplex Thermal Solutions manufactures two significant brands of chillers. The US-manufactured brand is Koolant Koolers® and the German-manufactured brand is Riedel®. Their ISO-9001 certified U.S. facility is based in Kalamazoo, Michigan where they also do in-house fabrication and testing. At the show, they shared a success story recently completed at the Arcadia Brewing Company in Michigan.
A 90-ton Koolant Kooler unit, with three independent modules — each using three 10 hp scroll compressors was installed. Modularity allows maintenance to be performed on one unit while still providing 60 tons of nominal capacity. The brewing facility now has glycol available for any cooling need — with some applications requiring consistent temperatures of only 27˚F. The new chiller provides cooling jackets, on tanks in the cellar, with the ability to cool up to 3800 gallons of beer from 70˚F to 32˚F within a day — representing a drastic improvement.

**Berg Chilling Systems**

Industrial ice-makers are used extensively in food processing plants, normally in post-production phases. Ice is an ingredient, for example, in high-speed mixers. Commercial fishing, produce, meat and poultry industries are some of the biggest users of cracked ice. Berg Chilling Systems had their industrial ice making machines on display. They manufacture models able to produce from 5 to 50 tons of cracked ice per day. Berg President Don Berggren said, “Our models are designed for food grade use. They use stainless steel ice making evaporator tubes, stainless steel perforated trough for water return and dewatering of discharge ice, and a stainless steel discharge auger for reducing ice fragments and delivering ice to the ice handling equipment.”

When asked about market trends with ice-makers and cooling systems, Mr. Berggren continued, “More factories are realizing the benefits of not applying HVAC systems to industrial processes. We are seeing more interest in customized solutions, with industrial chillers, allowing clients to realize kW and water savings. We are also seeing more utility incentive dollars being made available.”

**Frigel North America**

Frigel has a significant global market share, for cooling systems in the plastics industry. They say this market share growth is due to their in-depth understanding of the manufacturing processes of their clients and their ability to deliver customized cooling systems. They call it “intelligent process cooling.”
Frigel is challenging many “it’s always been done this way” conventions. They point out that cooling towers are notorious water-wasters and recommend a closed-loop system. In some cases, they will combine this closed loop system with point-of-use chillers and temperature control units to enhance production performance while minimizing energy and water consumption. Master chiller control systems are another technology they are beginning to deploy with more frequency.

“We’re excited to introduce this approach to the beverage industry given the value it offers for improved operational efficiencies, as well as goals associated with sustainability.” said Frigel CEO Duccio Dorin who had come over from Italy to announce their new strategic focus on the beverage industry. “We are especially pleased with the amount of interest we’ve seen from the media, which goes a long way in our effort to educate decision-makers about the concept and the benefits that can be achieved by moving toward an advanced and more intelligent approach to process cooling.”

**Thermal Care**

Thermal Care is one of the largest process cooling system suppliers in the U.S. OEM Sales Manager, John Grant, reviewed their 5 to 20 ton wash-down chillers with us featuring VFD drives, R410 refrigerant and a C-UL508 control panel. Also in the booth was the Accu Chiller portable EQ Series with air-cooled and water-cooled model sizes from ½ to 3 hp. The air-cooled units feature generously sized condensers for industrial conditions with ambient temperatures of up to 115°F.

John also said they are doing more and more “systems” work for clients attempting to bring all their different cooling applications into one optimized system. “Thermal Care can provide plant–wide process cooling system designs featuring cooling towers, central chiller systems, remote condensers, water treatment and filtration, piping and valve design, and heat exchangers.”

**ISEL Lubricants**

ISEL has recently impressed me as a very technically sound company with a real focus on agility and customer service. I enjoyed speaking with the Sandler Brothers, Michael and Dan, at their booth about air compressor and refrigeration compressor lubricants. Their air compressor lubricants are formulated to withstand tough ambient conditions and are rated at 100% fluid life at 212°F.
(100°C). Their standard synthetic formulations have a typical fluid life of 8,000 hours with their extended-life air compressor lubricant rated for 12,000+ hours according to their literature. Their food-grade formulations are non-toxic and non-hazardous so they can be disposed of in the same manner as mineral oils. They meet H1 requirements for incidental food contact as well as Kosher and Halal specifications. One formulation catching my eye is their advanced food-grade air compressor lubricant providing 8,000 hour fluid life at 212°F (100°C) discharge temperature. The standard food-grade lubricant is rated for 4,000-6,000 hours.

The NXT refrigeration compressor lubricants focus on ammonia, carbon dioxide and HFC/HCFC products. The ammonia products include food-grade, low-temperature and extreme low-temp compressor lubricants.

**MOKON**

The MOKON booth featured their water-based FULL RANGE temperature control system offering both process heating and chilling in one package. The temperature range is -20°F (-29°C) to 300°F (149°C), heating capacities go up to 96 kW, pumping capacities to 120 GPM and chilling capacities up to 40 tons.

Customized temperature control systems are right in Mokon’s wheelhouse. A snack food processor required independent water temperature control in 7 different zones of an extrusion barrel. Mokon designed a custom system, all within one cabinet, to meet the requirement of providing control from a single location. The processor benefited from the liberated floorspace and simplified electrical and plumbing installations and costs.

**Conclusion**

The Food Processing Suppliers Association (FPSA) is a global trade association serving suppliers in the food and beverage industries. FPSA members are organized in vertical industry councils focusing on specific needs and concerns that are unique to each industry sector. FPSA councils currently represent the Bakery, Beverage, Dairy, Prepared Foods and Meat sectors. For more information on FPSA visit www.fpsa.org. For more information on the Process Expo 2017 visit www.myprocessexpo.com. 

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"Corning launched a formal Global Energy Management program in 2006. U.S. operations consist of nearly 50 facilities. These management practices have saved more than $328 million in cumulative energy costs.”

– Patrick Jackson, Director of Global Energy Management, Corning Inc.

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