The Magazine for ENERGY EFFICIENCY and WATER CONSERVATION in Cooling Systems

CHILLER & COOLING BEST PRACTICES

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October 2020

COOLING TOWERS & CHILLERS

WATER TREATMENT & COOLING SYSTEM ASSESSMENTS

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BEST PRACTICES

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FEATURES

COOLING TOWER & CHILLER FEATURES

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COLUMNS

COVER PHOTO. This month's cover features a Utah State University installation of an EVAPCO eco-Air series V-configuration dry cooler for winter "free cooling." Image courtesy of EVAPCO.

FROM THE EDITOR

I hope our readers enjoy this issue as much as I have. Energy and water-efficient cooling system assessments continue to gain momentum and we thank Thermal Care, EVAPCO and SMC for providing some excellent examples this month. Refrigerants are, of course, an important part of the industry and Johnson Controls has supplied us with an update on factors impacting the transition to low-GWP refrigerants.

Cooling Tower & Chiller Features

I highly recommend taking a close look at the article, written by our own Mike Grennier, titled, "Schoeneck Containers Comes Out Ahead with Free-Cooling System." They installed an advanced hybrid cooling system able to reduce their related energy costs by 50%. What really caught my attention is the *cooling system assessment expertise* brought to the client by the vendor, Thermal Care.

Eaten a hamburger, hot dog or hoagie bun recently – noticed how they are nice and brown and crispy on the top? Buford Corporation is a leading OEM manufacturer of baking equipment, including the spray applicators used to enhance the browning process of buns prior to baking. They are the subject of a very interesting article, supplied to us by SMC Corporation of America, on how these two firms engineered the incorporation of a stainless steel chiller to improve the browning process for Buford's clients.

Water Treatment & Cooling System Assessment Features

The cover of our magazine this month features the installation of a dry-cooler and heat exchanger free-cooling system at Utah State University's main campus in Logan, Utah. Mihir Kalyani, from EVAPCO, has written an excellent article with detailed information covering all the firms (Midgely-Huber, Thomas Engineering, Spindler Construction and A&B Mechanical Contractors) who all collaborated to make this project a success.

Wondering about the future of R-134a and R-410a? We are very grateful to Chris Forth, from Johnson Controls, for sending us a very useful article titled, "A Closer Look at the State of Refrigerants." He reviews the legislative, economic and total system factors driving transitions to refrigerants with lower Global Warming Potential (GWP) equivalencies.

Best Practices EXPO & Conference Announcements

The Best Practices 2020 ONLINE EVENT! takes place September 23-24, 2020. Check out pre-recorded sessions from SPX Cooling Technologies, Danfoss, Carrier Commercial HVAC NA, and Thermal Care! This is free for all to register at www.cabpexpo.com

Reserve the dates for the Best Practices 2021 Expo & Conference taking place November 2-4, 2021 at the Schaumburg Convention Center located near Chicago O'Hare International Airport.

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

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ASHRAE Epidemic Task Force Releases Updated Building Readiness Guide

As many buildings are preparing to reopen during this pandemic, the ASHRAE Epidemic Task Force has updated its reopening "Building Readiness" guidance for HVAC systems to help mitigate the transmission of SARS-CoV-2.

"The Building Readiness Guide includes additional information and clarifications so that owners can avoid operating their HVAC systems 24/7," said Wade Conlan, ASHRAE Epidemic Task Force Building Readiness Team lead. "By rolling out this updated guidance, we are providing a more robust structure for building owners to complete the objectives of their Building Readiness Plan and anticipate the needs of building occupants."

Specific updated recommendations to the building readiness guidance include the following:

Pre- and Post- Occupancy with Outdoor Air: The intent of this strategy is to ensure that infectious aerosol in the building at the end of occupancy is removed prior to the next occupied period. The building is flushed for a duration sufficient to reduce concentration of airborne infectious particles by 95%. For a well-mixed space, this would require three air changes (three times the building volume) of outdoor air (or three equivalent air changes including the effect of filtration and air cleaners) as detailed in the calculation methodology. There is also guidance on methods to increase the quantity of outdoor air introduced by systems.

Energy Recovery Ventilation (ERV) Systems Operation: Guidance is provided to assist in determining if an energy recovery system using an energy wheel is well designed and maintained and whether it should remain in operation. Based on the assessment of ERV conditions, it may be possible to fix problems and return it to service.

Building Readiness Modes of Operation for the Building: These should include the following:

- Epidemic Operating Conditions in Place (ECiP)
  - Occupied- at pre-epidemic capacity
  - Occupied- at reduced capacity or Unoccupied temporarily
  - Operation during building closure for indefinite periods
- Post-Epidemic Conditions in Place (P-ECiP)
  - Prior to Occupying
  - Operational Considerations once Occupied

The guidance still addresses the tactical commissioning and systems analysis to develop a Building Readiness Plan, increased filtration, air cleaning strategies, domestic and plumbing water systems, and overall improvements to a systems ability to mitigate virus transmission. To view the complete ASHRAE Building Readiness guide and other COVID-19 resources, visit ashrae.org/COVID-19.

About ASHRAE

Founded in 1894, ASHRAE is a global professional society committed to serve humanity by advancing the arts and sciences of heating ventilation, air conditioning, refrigeration and their allied fields. As an industry leader in research, standards, writing, publishing, certification and continuing education, ASHRAE and its members are dedicated to promoting a health and sustainable environment for all. For more information, visit www.ashrae.org.

Danfoss Introduces 450-ton Turbocor VTX1600 Compressor

Danfoss has announced the launch of its highest-capacity oil-free compressor yet – bringing the benefits of Danfoss Turbocor magnetic bearing technology to larger water-cooled chillers.

The Danfoss Turbocor VTX1600 oil-free, centrifugal compressor with magnetic bearing technology.

With a nominal capacity rating of 450 tons/1,600 kW, the Danfoss Turbocor VTX1600 is well placed to bring efficiency and long-lasting performance to larger applications like hospitals, data centers and university campuses. Multiple configurations, delivering capacities in excess of 3,600 tons/12,600 kW, are possible.

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The VTX1600 is built around the same Turbocor technology that's proven so effective in more than 80,000 chillers worldwide – delivering high efficiency, low maintenance, and low noise, with zero performance degradation over the compressor's life.

Like all Danfoss Turbocor compressors, it's built in the USA and China to ISO 9001:2015 and ISO 14001:2015 standards, with unparalleled service and support from the world's leading supplier of oil-free compressor technology. The permanent magnet synchronous motor and integrated variable speed drive provide high efficiency and enable compact design. Two-stage compression allows for stable operation over a wide range of application conditions.

But the VTX1600 offers a step up in more than just capacity. Its Inlet Guide Vanes (IGV) – adapted from the most popular Turbocor models – and advanced aero design combine industry-leading full-load efficiency with outstanding unloading capability, even at constant entering condenser operating conditions.

The result is a high-capacity compressor that delivers world-class efficiency under all load conditions, using the world's most trusted oil-free technology and a large operating map to suit a wide range of application conditions.

"VTX1600 represents five years of refinement and innovation at the high-capacity end of the Danfoss Turbocor range," said Eddie Rodriguez, Aftermarket Product and Service Manager for Danfoss Turbocor. "Chiller OEMs have wanted this for some time. Now, they're able to use the Turbocor technology they know and trust to deliver efficiency and long-lasting performance in larger applications. Compared to screw non-inverter compressors, that means they can do away with oil management maintenance, cut noise, and improve part-load efficiency by up to 30%."

The Danfoss Turbocor VTX1600 is designed for use with R134a, and offers a choice of three discharge connection alignments for maximum design flexibility.

About Danfoss

Danfoss engineers advanced technologies that enable us to build a better, smarter and more efficient tomorrow. In the world's growing cities, we ensure the supply of fresh food and optimal comfort in our homes and offices, while meeting the need for energy-efficient infrastructure, connected systems and integrated renewable energy. Our solutions are used in areas such as refrigeration, air conditioning, heating, motor control and mobile machinery. Our innovative engineering dates back to 1933 and today Danfoss holds market-leading positions, employing 27,000 and serving customers in more than 100 countries. We are privately held by the founding family. For more information, visit www.danfoss.com.

Thermal Care Enhances Accuchiller NQ Series

Thermal Care just released an update to their Accuchiller NQ Series portable chillers to include a new control system and cabinetry design. These chillers are now even easier to own and operate.

The newly redesigned NQ Series chillers come standard using an advanced PLC control system with ModBus RTU and a 7-inch color touch screen. This robust control system provides premium performance and extensive diagnostic capabilities with a wide range of communication options including Modbus, BACnet, and LonWorks. Screen layouts are improved to simplify finding data in an easy to follow format. Pressure sensors are now included as part of the control system package for even more reliable and accurate information. The NQ Series control panel cabinetry is also redesigned to include an ergonomic sloped top for easy viewing and access.

The newly redesigned Accuchiller NQ Series portable chillers from Thermal Care.

"Precise control technology is so important in today's manufacturing world. Our customers asked for an upgrade and we delivered. This simple-to-use controller comes with complete diagnostic information available at the touch of their fingertips. All the information is right there from settings to troubleshooting and trending data," said Peter Armbruster, Director of Sales & Marketing at Thermal Care. "If you include an optional variable speed compressor package, you have a chiller that can pay for itself in energy savings."

Units will be ready for shipment September 15, 2020. NQ Series Portable Chillers are available from 4 to 40 tons in both air-cooled, water-cooled, and remote condenser models for indoor and outdoor applications.

About Thermal Care

Founded in 1969, Thermal Care is a developer of leading-edge process cooling technology with energy-saving and cost-efficient product designs. The company provides heat transfer equipment to more than 50 industries and specializes in meeting the specific needs of all customers by offering both standard and custom designed industrial process cooling solutions. Thermal Care's broad product line includes portable and central chillers, cooling towers, pump tanks and temperature controllers. The company also delivers extensive experience and engineering knowledge to develop and execute plant-wide cooling solutions. For more information, visit www .thermalcare.com.

Daikin Applied Launches New Heat Pump Technology

Daikin Applied has introduced the Daikin SmartSource Dedicated Outdoor Air System (DOAS), its next generation of heat pump heating technology that enables efficient and cost-effective heating and cooling in all conditions using 100% of fresh, outside air. The new unit features exclusive SmartBoost Heat Technology, which allows for air as cold as 0°F to enter without any pre-heating, all while achieving 49% higher than ASHRAE 90.1-2016 minimum efficiency.

"Striking the right balance between maintaining fresh, clean air throughout a building – and doing so cost-effectively – is no simple task, but it's increasingly important today as we think about how to achieve healthy indoor environments," said Alan Youker, Daikin Applied Product Manager. "The SmartSource Dedicated Outdoor Air System is a new technology for facility managers seeking a reliable and tech-forward way to ensuring optimal indoor heating and cooling with unmatched efficiency."

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The SmartSource DOAS taps a water source heat pump's hot gas reheat coil in addition to the unit's primary DX coil. The resulting heating efficiencies—up to 5.1 ISCOP2 per AHRI 920-2020—coupled with the latest advancements in electronically commutated motors and industry-leading shaftless blower technology help ensure premium performance.

The SmartSource Dedicated Outdoor Air System heat pump heating technology from Daikin Applied.

Key features of the new SmartSource DOAS include, multi-stage, uneven compressor tandem that provides eight stages of heating and cooling control, ranging from 100% to 30% operating capacity. The DOAS also includes programmable options for either constant or variable airflow control, ranging from 70 to 200% of nominal airflow, and external static pressures over 2 inches achieved at nominal unit airflow. Also incorporated is Daikin's new, BACnet-enabled MicroTech controller, which marries advanced unit control, built-in control logic and smart safety features with a user-friendly interface. The controller automatically selects between heating, cooling or dehumidification modes of operation, and its dynamic control can achieve discharge air temperature accuracy within one degree under steady conditions.

About Daikin Applied Americas

Daikin Applied Americas, 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. visit www.DaikinApplied.com.

SPX Cooling Technologies Introduces IEC Evaporative Condenser

SPX Cooling Technologies, Inc., a full-line, full-service industry leader in the design and manufacture of specialized heat exchangers, introduced the SGS brand IEC evaporative condenser, a blow-through condensing unit for industrial refrigeration applications, specifically designed and built to simplify installation for contractors and provide robust componentry and extended life for operators.

Among the IEC Evaporative Condenser features that speed installation for contractors are built-in spreader bars for simplified crane lifts, self-aligning top and bottom modules that require only four bolt connections to speed field installation, and a header collar that positively seals the connection plate between the casing and header pipe, virtually eliminating the potential for leaks.

For operators of refrigerated facilities, the IEC Evaporative Condenser is an industrial-grade product designed to reliably support the refrigeration plant while providing maintenance advantages and extended product life. Features include exclusive optional hot-dip galvanized (HDG) casing for superior corrosion protection,

and exclusive nuts and bolts construction throughout structure for greater stability. Additional features include a fully welded, HDG fan system with full fan partitions for staging operations, and casing flanges that angle downward to shed water, debris and allow two directional sealing, plus framed HDG coils to square sections and eliminate air bypass gaps.

For easy maintenance access, motors are protected from environmental exposure, and vertical motor adjustment for easy belt tensioning is available. An all polymer spray system with low-clog nozzles and quick coupling makes for simple removal.

To meet the specific requirements of industrial refrigeration airside applications, SGS brand IEC blow-through models are offered in 10-foot and 12-foot nominal widths and four nominal lengths from 12 to 36 feet.

About SPX Cooling Technologies

SPX Cooling Technologies is a leading global manufacturer of cooling towers, fluid coolers, evaporators and evaporative condensers. For nearly a century we have provided full-service cooling solutions and support to customers in heating, ventilation and air conditioning (HVAC), industrial and commercial refrigeration, and industrial process cooling applications. In 2019, SPX Cooling Technologies acquired SGS Refrigeration. The SGS brand includes evaporators and evaporative condensers used in a broad range of industrial refrigeration airside processes. SPX Cooling Technologies and its product brands are part of SPX Corporation. For more information, visit www.spxcooling.com.

The SGS Brand IEC Evaporative Condenser from SPX Cooling Technologies.

Johnson Controls Launches OpenBlue Healthy Buildings

Johnson Controls, the global leader for smart and sustainable buildings, announced it will launch a comprehensive suite of digital solutions, called OpenBlue Healthy Buildings, to make shared spaces safer as people begin to return to offices. Combining 135 years of building systems expertise with cutting edge technology, these solutions protect and instill confidence in building occupants and visitors, minimize disruption should employees test positive for COVID-19, and accelerate building re-occupancy by automating and streamlining safety protocols. Additionally, customers will be able to maximize occupancy targets while maintaining safety, understand how their spaces are used and repurposed easily based on data, and help employees be more productive when they are in the office.

OpenBlue Healthy Building solutions, which are integrated but can also be deployed modularly, include a combination of hardware and software – such as smart equipment, digital sensors, security systems, cameras,

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monitors, powerful analytics and dashboards, infection control and other connected devices – as well as a mobile app to manage spaces and occupant experiences. The Workplace solution is developed using Privacy by Design and supports Privacy by Default. Solutions to re-enter, reoccupy and reimagine include:

Contact tracing. Automated contact tracing capabilities are the foundational element of this suite of solutions and enable other technologies. Overall, these solutions allow building management and employers to understand risks of exposure for building occupants. In the event of an occupant testing positive, the system can retroactively trace person-to-person and person-to- space contact to provide nearly immediate support to Human Resources and Facility teams in reaching out to at risk workers, addressing potentially impacted areas, and taking preventive measures to minimize spread. Furthermore, contact tracing provides peace-of-mind for employees in the event someone has tested positive.

Social distancing monitoring. OpenBlue Healthy Buildings will monitor social distancing in real- time, sending violation alerts should occupants be too close together or spaces become over occupied, enabling extensive compliance reporting and real-time behavior changes to prevent infection spread.

Thermal cameras. To ensure a holistic approach to safety, OpenBlue Healthy Buildings includes temperature screening technology that takes measurements while an individual is walking to allow for frictionless entry and exits, and prevent infection spread.

Scenario Planning. Solutions proactively determine connections between people and spaces, predict impacts from possible negative events, and enable intervention before disruption and reduces risk.

Infection control. OpenBlue Healthy Buildings creates a layered approach to connectivity between various systems integral to infection control. These include, but are not limited to, systems that reduce indoor and airborne pathogens by increasing outdoor air ventilation, disinfecting ultraviolet C (UV-C) lighting, and remote monitoring of room pressurization, air change rates, humidity, and temperature to create healthier air.

Mapping and monitoring space utilization. The OpenBlue mobile app provides live map views of sanitization status, occupancy data and recommendations for navigating the building safely in order to maximize and monitor how spaces are being used. The system is platform agnostic and works seamlessly with existing building management systems to support activities such as booking conference rooms or individual workstations with indication of sanitization status.

Enhanced communication and experiences. The mobile app helps engage employees and occupants in real-time by providing updates about shared spaces and new policies, preferred wayfinding to avoid crowded areas, space availability and safety details, phone as badge access, SOS response, rotational schedule support, health attestation and self-reporting options, and more. These increase communication touchpoints between building management, human resources and employees to provide real-time information and fuller transparency, while also supporting productivity and experience features, such as calendar integration and comfort control

"As more buildings welcome back their employees, it's critical we deploy cutting edge technology coupled with our building expertise to create the smartest, safest spaces and places for occupants and visitors," said Mike Ellis, executive vice president, chief digital & customer officer, Johnson Controls. "We are innovating with partners and customers to create technology that will transform buildings and spaces, from thermal cameras to contact tracing capabilities, OpenBlue is an end-to-end solution."

Johnson Controls OpenBlue platform – launched in July 2020 – was designed with agility, flexibility and scalability in mind, to enable buildings to become dynamic spaces. In leveraging the platform, customers will be able to manage operations more systemically, delivering buildings that have memory, intelligence and unique identity.

Emerson and MHPS Collaborate on Power Industry Digital Transformation

Emerson and Mitsubishi Hitachi Power Systems Americas (MHPS) are joining forces again to develop digital technologies, software and services to help utility customers drive operational excellence in North America. The companies will collaborate on digital solutions to optimize performance and reliability, enable predictive and AI-driven maintenance strategies, and automate operational decision-making.

The collaboration will build on the expertise of Emerson and MHPS to enhance the

performance and reliability of power plants operating with MHPS gas or steam turbines.

Emerson's Ovation automation technologies, software and solutions portfolio for power generation is highly regarded in the industry, controlling thousands of plants across the globe. Its embedded digital twin enables power plants to identify and implement new operating efficiencies, improve safety, decrease unscheduled maintenance and train workers.

As a leading global provider of power generation and energy storage solutions, MHPS is driving the development of next-generation power plants and digital solutions that deliver higher efficiencies to reduce carbon emissions and the highest levels of reliability to lower maintenance costs. Its industry-known MHPS-TOMONI digital solutions platform provides real-time adaptive control and actionable knowledge to optimize plant performance and significantly improve reliability.

"Emerson has worked collaboratively with MHPS for over a decade to bring the best experts, technologies and services to the power generation industry," said Bob Yeager, president of Emerson's power and water solutions business. "This next chapter will focus on identifying and delivering the best digital transformation strategies and technologies that will drive operational performance for our customers and create cleaner, more reliable power for consumers."

The two companies will explore these and other advanced technologies: advanced sensing; thermal, process and equipment modeling and diagnostics; advanced control; analytics; pattern recognition; remote monitoring; digital twin; automated workflows; and AI-driven predictive maintenance.

One of the companies' collaborations is to build and deploy the next generation of total plant simulation for the Intermountain Power Plant Renewal project. "This collaboration leverages Emerson's digital twin technology, MHPS' high-fidelity gas turbine and steam

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turbine models, and advanced analytics. The simulation solution will seamlessly receive data and operate in parallel with the plant's integrated control systems and other enterprise platforms to support commissioning and training," said Marco Sanchez, vice president of intelligent solutions at MHPS.

Paul Browning, president and CEO of MHPS Americas and chief regional officer for Europe, Africa, the Middle East and the Americas, said, "MHPS looks forward to this next stage of collaboration with Emerson as we continue developing digital solutions that will enable our customers to provide affordable and reliable electricity, maximize profitability of existing and future power plants, and combat climate change. Together with Emerson and our customers, we will achieve a Change in Power."

About Emerson

Emerson, headquartered in St. Louis, Missouri (USA), is a global technology and engineering company providing innovative solutions for customers in industrial, commercial and residential markets. Our Automation Solutions business helps process, hybrid and discrete manufacturers maximize production, protect personnel and the environment while optimizing their energy and operating costs. Our Commercial & Residential Solutions business helps ensure human comfort and health, protect food quality and safety, advance energy efficiency and create sustainable infrastructure. For more information, visit www .Emerson.com.

About Mitsubishi Hitachi Power Systems Americas, Inc.

Mitsubishi Hitachi Power Systems Americas, Inc. (MHPS Americas), headquartered in Lake Mary, Florida, employs more than 2,000 power generation and energy storage experts and professionals. Our employees are focused on empowering customers to affordably and reliably combat climate change while also advancing human prosperity. MHPS Americas' expertise includes natural gas, steam, aero-derivative, geothermal, and distributed renewable power generation technologies and services, along with renewable hydrogen and battery energy storage systems, environmental control systems solutions, and digital solutions enabling autonomous operations and maintenance of power assets throughout North and South America. MHPS Americas is a subsidiary of Mitsubishi Hitachi Power Systems (MHPS), a joint venture between Mitsubishi Heavy Industries, Ltd. and Hitachi, Ltd. integrating their operations in power generation systems. MHPS recently announced that its name will soon change to Mitsubishi Power. Learn more about MHPS by visiting www.changeinpower.com.

The Emerson and MHPS alliance brings together technology leaders to develop next-generation digital software and solutions that optimize power plant performance and reliability through AI-driven strategies and automated decision-making.

Johnson Controls Appoints Diane Schwarz As Chief Information Officer

Johnson Controls, the global leader for smart and sustainable buildings, today announced Diane Schwarz has joined the Company as its chief information officer (CIO).

In this role Schwarz will be responsible for leading an integrated, reliable, business-aligned information technology (IT) organization. She will develop and execute an enterprise-wide IT strategy that continues to merge technology operations to ensure a strong foundation for Johnson Controls to scale and achieve its global growth objectives.

Schwarz most recently served as Senior Vice President & Chief Digital and Information Officer at Hunt Consolidated, a privately held Global Energy and Real Estate company. Previously, she served as Vice President & Chief Information Officer for Textron, an industrial,

Schwarz received a Bachelor of Science degree in mechanical engineering from The University of Notre Dame and her MBA from the University of Chicago, Booth School of Business.

aerospace and defense manufacturer. Earlier in her career Schwarz worked for Bell Helicopter, Sonitrol Corporation, Honeywell, Nestle Foods and Ernst & Young.

"Diane is a seasoned global business leader who will help Johnson Controls anticipate sweeping technological changes and identify opportunities for our IT team to innovate and deliver world-class customer service," said George Oliver, chairman and CEO. As our suite of connected solutions continues to be enhanced and we leverage our tailored services and capabilities under our new dynamic digital architecture, OpenBlue, Diane's leadership will play a vital role in liaising with our product and engineering groups to serve as a hub for innovation and business enablement."

About Johnson Controls

At Johnson Controls, we transform the environments where people live, work, learn and play. From optimizing building performance to improving safety and enhancing comfort, we drive the outcomes that matter most. We deliver our promise in industries such as healthcare, education, data centers and manufacturing. With a global team of 105,000 experts in more than 150 countries and over 130 years of innovation, we are the power behind our customers' mission. For more information, visit www.johnsoncontrols.com.

COOLING TOWERS AND CHILLERS

Schoeneck Containers Comes Out AHEAD WITH FREE-COOLING SYSTEM

By Mike Grennier, Chiller & Cooling Best Practices Magazine

An advanced hybrid system featuring a closed-loop adiabatic fluid cooler and central chiller with free-cooling capabilities helps Schoeneck Containers, Inc. reduce energy costs at its new facility in Delavan, Wisconsin.

Schoeneck Containers, Inc. (SCI) is a company that thinks a lot about its future – and how to continue to maintain a long track record of profitability and reliability while meeting a growing demand for its quality plastic containers for customers throughout North America.

It's the kind of thinking driving the decision to install a closed-loop adiabatic fluid cooler and central chiller with free-cooling capabilities at the company's new 250,000-square-foot production facility in Delavan, Wisconsin.

With the advanced hybrid cooling system in place, SCI stands to reduce energy costs for cooling at the facility by nearly 50% per year when compared with cooling technologies without free-cooling capabilities. And, said SCI Facilities Engineering Manager Bill Bushman,

"Once you've got a stable and consistent cooling system you can keep a tight rein on process control and increase cycle times, product quality and overall profitability."

— Bill Bushman, Facilities Engineering Manager, Schoeneck Containers, Inc.

the company's approach to process cooling lets it do what it does best: delivering customer satisfaction and maintaining strong growth.

"This system lets us focus less on the cooling and more on the equipment and process of manufacturing quality containers since we know we've got a robust system that just runs without taking a whole lot of effort to oversee it."

Strong Growth Fuels Expansion

SCI supplies plastic containers for diverse consumer and commercial markets. Since its inception in 1972, it has experienced steady growth as a supplier of containers for food, beverage, personal care, household, industrial, nutraceutical , wipes and pet care products. The company employs 170 people.

For decades, SCI produced containers at its 172,00-square-foot headquarters facility in the Milwaukee suburb of New Berlin, Wisconsin. To do so, it regularly updated its headquarters operation and added production lines to meet demand. Eventually, growth led to the construction of its new facility in nearby Delavan, which began operation in 2019.

The new facility uses injection molding and blow molding machines to produce a wide range of containers. Designed to accommodate continued expansion, it includes six production lines with two injection molding machines and four blow-molding machines operating 24 hours per day, seven days a week.

Bushman said SCI built the new facility with plenty of room for growth since the outlook for the company has never been better, which

Located outside SCI's new production facility is a Thermal Care HFCG 250-ton, closed-loop adiabatic fluid cooler.

is due to a skilled and talented workforce and a philosophy of meeting customers where they need to be met.

"Our claim to fame is our willingness to be flexible with our customers in terms of the types of packaging configurations they're looking for in plastic containers," Bushman said. "We don't just deliver full-size palletized skids. Instead, we handle special orders, work with smaller companies and we're flexible as far as how and what we can deliver."

Energy Savings a Top Priority

After reviewing process cooling options for the Delavan facility, SCI decided to work closely with Thermal Care to install a hybrid system combining a closed-loop adiabatic fluid cooler with a water-cooled chiller to meet the operation's cooling needs – and its strategic goals. Based in Niles, Illinois, Thermal Care (www.thermalcare.com) is a leading manufacturer of water chillers, process cooling equipment and systems for applications worldwide.

The ability to reduce energy savings costs was a primary factor in choosing a hybrid cooling system, Bushman said.

"The energy savings and return on investment it offers was a main driving force, especially since we knew we could remove energy costs for a good portion of the year," he said, adding that reliability also played a key role in the decision given the importance of process cooling. "Process cooling really defines the plastics process. Once you've got a stable and consistent cooling system you can keep a tight rein on process control and increase cycle times, product quality and overall profitability."

The company also headed into the planning and design of the process cooling system with a clear vision for adding additional cooling capacity to meet increased production.

SCHOENECK CONTAINERS COMES OUT AHEAD WITH FREE-COOLING SYSTEM

"Even though we started with one machine at the new facility, we added another machine every six to nine months and that's pretty much the timeline going forward," Bushman said.

Taking Advantage of Free Cooling

Installed at the new facility in 2018, the cooling system capitalizes on free-cooling capability and the use of a water-cooled chiller with Variable Speed Drive (VSD) technology to save energy. The closed-loop adiabatic fluid cooler, which is designed to fit in a small footprint, also saves water and water treatment costs versus a traditional open cooling tower since it only uses a small amount of water in the evaporation process to generate chilled water.

The facility's cooling system consists of a HFCG 250-ton, closed-loop adiabatic fluid cooler located outside the new facility and a TCW700 250-ton water-cooled central chiller inside the facility. It also includes adiabatic fluid cooler and chiller pump tanks as well as a free-cooling heat exchanger, and Aquatherm Polypropylene (PP-R) piping. The system is designed to provide chilled water to the processes at 55˚F (12.8˚C). In the meantime, SCI uses two temperature control units to more precisely control chilled water temperatures delivered to the injection molding machines.

The hybrid system is configured so the adiabatic fluid cooler continuously supplies a mixture of chilled water and glycol to the free-cooling heat exchanger and the chiller year-round. The closed-loop adiabatic fluid cooler uses ambient air – and evaporation when needed – to cool process water in a closed-loop coil. The plate-and-frame heat exchanger, meanwhile, allows heat transfer to occur between the water-glycol mix supplied by the adiabatic fluid cooler and clean chilled water supplied to plant processes via the pump tanks and piping.

Inside the new SCI production facility is a Thermal Care TCW700 250-ton water-cooled central chiller.

Free-cooling takes place when ambient temperatures are consistently below 50˚F (10˚C), which is typically from fall through spring in Southeastern Wisconsin. When operating in free-cooling mode, the system automatically shuts down the chiller since the adiabatic fluid cooler can efficiently cool process water and supply all the chilled water needed. Doing so saves energy and cost since cooling is provided without the need to operate the chiller's refrigeration compressor, which is typically the most significant consumer of power in any process cooling system.

During the hot summer months when ambient temperatures are consistently above 50˚F (10˚C), however, the ability of the adiabatic fluid cooler to generate chilled water is limited by ambient temperatures. As such, the system activates the chiller in order to supply chilled water to the processes. Key to the system is a three-way valve that automatically opens and closes based on ambient temperatures to allow process cooling water to flow to the processes through only the chiller or the glycol-free side of the heat exchanger.

For additional energy savings, the chiller is engineered with a VSD centrifugal refrigeration compressor to efficiently operate at part load as dictated by the cooling load. The entire system is also automatically set to shift to free-cooling based on one-degree increments in order to gradually reduce the load on the chiller when ambient conditions approach the 50˚F setpoint.

Reliable Winter and Summer Operation

While energy savings are a top priority, a hybrid cooling system also allows SCI to avoid issues encountered with the process cooling system and free cooling at the headquarters plant in New Berlin during winter months. Additionally, it helps reduce water consumption and water treatment costs at the new plant.

The headquarters process cooling system consists of two open cooling towers and two water-cooled chillers and is configured to

SCHOENECK CONTAINERS COMES OUT AHEAD WITH FREE-COOLING SYSTEM

The pump station at SCI's Delavan includes adiabatic fluid cooler and chiller pump tanks for routing chilled water through the process cooling system via Aquatherm Polypropylene (PP-R) piping.

allow for free cooling. The system helps SCI achieve energy efficiencies, yet at the same time, opportunities for savings are curtailed due to problems with ice buildup during the winter.

"With a typical Wisconsin winter you can have temperatures that are minus 10˚F (minus 23.33˚C) or minus 20˚F (minus 28.29˚C)," Bushman said. "That has caused problems with ice buildup and things like that from time to time with our system at that operation, which prevented us from using free cooling as much as we wanted. But we were able to get away from that problem with a closed-loop system at our new facility since it operates in dry mode in winter."

Bushman said he also appreciates how the closed-loop system allows the new plant to minimize water consumption and keep a lid on water treatment costs since there is no need to replace or treat large quantities of evaporated process water. "We don't go through a lot of water like we do with the open cooling towers at our New Berlin facility," he said. "We also don't have to spend a lot of money on water treatment; the cost for treatment at the new facility is less than a quarter of what we pay at our New Berlin plant."

The monitoring and measuring capabilities of the integrated PLC control system are yet another advantage of the hybrid system, especially given the importance of plant uptime, Bushman said.

"Since it's an automated system we don't need to pay a lot of attention to it. And it provides remote access so Thermal Care can dial it up and see how efficiently we're running at any time and do troubleshooting if it's needed. Given the scheduling demands we have and the cost for downtime, it just make sense."

Energy Savings and Growth Secured

For SCI, 2019 marked the first full year of operation for the hybrid cooling system. As planned, the bustling operation was able to supply its injection molding and blow molding machines with ample cooling, while also saving on energy.

"We're planning to look at the data closely in the next six months after we add another production line to the facility, but we know we benefited since we were able to use free cooling from November 2019 through March of 2020," Bushman said. "We're happy with the return on investment. And because of what we learned by implementing this type of system in Delavan, we're looking at upgrading our New Berlin facility in the next couple of years with some of the same technology."

In the meantime, Bushman said the hybrid system at the new plant is well prepared for steady growth in keeping with SCI's business forecast. Toward that end, the system was designed so the company only needs to add an adiabatic fluid cooler, heat exchanger and pump to double the cooling capacity of the existing system.

"We have enough room in the facility for a total of 12 to 14 injection molding and eight blow molding lines. We had to be forward thinking in how we approached this and how we set up space for future equipment. We just had a management meeting where we discussed plenty of opportunities. Things are looking good." BP

All photos courtesy of Schoeneck Containers, Inc.

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WATER TREATMENT & COOLING SYSTEM ASSESSMENTS

Assessment Leads to Investment in FREE COOLING AT UTAH STATE UNIVERSITY

By Mihir Kalyani, EVAPCO

An EVAPCO eco-Air series V-configuration dry cooler was installed at the USU central energy plant to provide winter cooling capacity.

Founded in 1888, Utah State University's (USU) main campus in Logan, Utah, is home to roughly 20,000 students. USU is the state's only land grant institution, offering 168 undergraduate degrees.

The campus saw massive growth during the 1990s with its endowment increasing by more than tenfold. It went from a small regional college to a nationally prominent university, even adding a campus – USU Eastern, in Price, Utah.

As the main campus expanded, so did the need for cooling capacity. A central energy plant was constructed in the northern part of the campus. This facility provides cooling to the bulk of the campus. Since its construction,

"During this past season, which was a milder winter than usual, the dry fluid cooler and associated components used 691 megawatts; a full 21% energy reduction."

— Mihir Kalyani, EVAPCO

however, freezing ambient conditions have created maintenance and longevity issues for the open-loop cooling tower system at the university. As a result, USU looked for alternative cooling system options.

Winter Cooling Tower Challenges

"Evaporative cooling capacity for the district system is provided by a six-cell, open-loop cooling tower capable of 6,000 tons," said Reid Olsen, USU Central Energy Plant Manager, who has been at the university for 26 years. "This tower serves the condensers of the water-cooled chillers at the heart of the district cooling system. There are four chillers in all, two of which are rated for 1,800 tons each, and the other two are 900 tons apiece. The cooling towers reject heat from the condenser water loop via evaporative cooling, allowing the chillers to supply chilled water to the campus cooling loop."

Utah State University's main campus in Logan, Utah, is home to roughly 20,000 students.

During heating season, the campus cooling load drops by more than 90%. For roughly half the year, only server rooms and a constant temperature room in the library call for cooling capacity. It's during this time that the university's maintenance crew battle to mitigate ice buildup damage to the 16-year-old cooling towers.

"We're at about 4,500 feet above sea level here," said Olsen. "It's common that our outdoor ambient temperatures drop below -10°F (-23.33°C) and stay there for weeks at a time, and -30°F (-34.44°C) isn't unheard-of."

Since they were constructed, the cooling towers have been a winter maintenance challenge. Fill media within the towers freezes solid, building up so much weight that ultimately results in damage to the units. After a decade of this, several of the cells required complete fill media replacement at a tremendous expense, despite efforts to combat the issue.

"We stopped using the tower unless absolutely necessary," said Olsen. "Warming up the condenser water by turning the fans off only lessened the damage. What we really needed was an entirely different solution for the winter months – one that would allow us to completely shut down the cooling tower during the winter."

Olsen and others on the maintenance crew began discussing alternatives to the open-loop cooling tower for the winter months. The cold, dry conditions are conducive to the use of a dry cooler, and there was still a bit of room on the central plant roof where one could be mounted. A dry cooler is a closed-loop system, which would offer additional benefits for cold weather operation. At the time of construction, the dunnage supporting the large cooling tower had been oversized for the possibility of adding a seventh cell, if the need arose.

Finding the Right Solution

Research began, and Olsen found information about several dry cooler models. One of these stood out because it was carried by a local manufacturer's representative that did extensive work with the university in the past.

ASSESSMENT LEADS TO INVESTMENT IN FREE COOLING AT UTAH STATE UNIVERSITY

"I reached out to Midgley-Huber, Inc., in March of 2019, and was put in contact with Conrad Campos, Midgley-Huber Outside HVAC Salesman," said Olsen. "He visited the site, collected load information and measured the physical space we had to work with on the roof. Much of the information needed by Campos had already been compiled by our consulting engineering firm, Thomas Engineering Co., including the size of all system components and general design."

The university needs 250 tons of cooling throughout the winter. The biggest constraint was the total length of the new dry cooler could not exceed 25 feet, which included space for circulation of air around the unit. Given the challenges, Campos discussed options with EVAPCO.

"The goal was to have the ability to shut down the open-loop cooling tower for several months while ambient air temperatures are low enough to satisfy the cooling load with a dry cooler. The university wanted to remain in dry operation as long as possible."

Meanwhile, the university sought other bids for dry cooler solutions and began early planning with Gary Stevens, at Spindler Construction Corp. The company, out of Logan, Utah, was the general contractor on the project, providing coordination and full project oversight.

Ultimately, the decision was made to select an EVAPCO eco-Air series V-configuration dry cooler. The unit's competitive price, the availability of stainless steel construction and correct physical dimensions, the provision of maximum cooling capacity, and the university's familiarity with Midgley-Huber made it the winning combination.

"The fact that EVAPCO tests and rates their dry cooler performance per the newly-adopted Cooling Tower Institute (CTI) test code CTI ATC-105DS was also a determining factor for USU," said Campos. "This means the performance of the unit has been verified, and EVAPCO offers a comprehensive performance guarantee."

Stainless steel construction for both the structure/casing and coils was an option for the dry cooler, though it wasn't originally specified. EVAPCO presented the option to A&B Mechanical, Salt Lake City, Utah, and the university recognized the longevity advantage over galvanized construction.

The unit was ordered with EC (electronically commutated) motors powering its 12 fans. This allows full fan speed control from zero to 100%, providing increased energy efficiency and reduced noise levels.

Straightforward Installation

Installation of the new eco-Air fluid cooler took place in July and August of 2019. The campus was mostly vacant for summer break, simplifying crane and truck movement. Spindler Construction handled construction of the cooler dunnage and lifted the unit into place. A&B Mechanical Contractors provided expertise, and the manpower to install all associated piping.

The existing cooling tower dunnage was modified to allow the fluid cooler to be craned to the roof and mounted to maximize space. The closed-loop dry cooler utilizes a 40% glycol solution for freeze protection. As such, a large plate-and-frame heat exchanger was installed to separate the glycol solution circulating through the cooler from the chilled water loop. The plate-and-frame heat exchanger is sized for the maximum 650

There was just enough room on the roof of the central energy plant at USU's facility to install the fluid cooler based on existing dunnage.

gallons per minute (gpm), though it typically circulates at 500 gpm, providing roughly 375 tons of heat transfer capability.

The dry cooler and the heat exchanger together are only utilized for "free cooling." When the ambient air temperature is low enough the chillers can be turned off and the dry cooler can satisfy the reduced cooling requirement during the colder months.

Olsen and Campos assisted A&B Mechanical with system startup in September.

"Startup and programming of the controls was very intuitive," said Olsen. "With the cooler set up, all my team needs to do is specify the leaving water temperature; usually about 38°F (3.333°C). Based on the incoming water temperature, typically about 48°F (8.889°C), the intelligent control determines the units' fan speed. We could even set a maximum fan speed through the factory control if noise was a concern, but that's not the case here."

Once the controls were programmed, the unit was started and ran for several hours. It wasn't actually put into full service until October 1, 2019. Winter ambient temperatures and low cooling load mean the chillers can be bypassed, and the dry cooler can be used to provide the temperatures required by the chilled water loop, saving energy by not running the chillers' refrigeration compressors. Fluid from the load side of the heat exchanger is pumped directly to the district loop.

Freezing Issues Solved

"We were able to utilize the EVAPCO fluid cooler as our sole cooling source from October 1 through April 1," said Olsen. "We'd been running the cooling tower unnecessarily for half the calendar year, and if we wanted to, we could probably push the dry cooler for another two to four weeks. Generally speaking, daytime ambient temperatures need to remain below 50°F (10°C) for the dry cooler system to satisfy the load."

For the university, avoiding freeze damage to the cooling tower was the number one priority, but there were other benefits, as well.

Between October and April of the previous season, the open-loop cooling tower system consumed 871 megawatts of electric energy. During this past season, which was a milder winter than usual, the dry fluid cooler and associated components used 691 megawatts; a full 21% energy reduction.

Maintenance expenses fell as well. In addition to reducing damage to the cooling tower and wear and tear on chillers, fans and pumps, using the dry fluid cooler reduced man hours needed to monitor and tend to the cooling tower system. It also reduced the amount of water treatment chemicals needed for the open-loop tower.

The university needed to communicate, remotely, with the dry cooler. Along with BACnet and other communication protocols, EVAPCO dry and adiabatic coolers come with MODBUS RTU communication protocol. This enables the Building Control/Management System to remotely control and monitor the unit.

"We're fortunate in that Logan has cheap, ample water," said Olsen. "We haven't tracked our water savings through this improvement, but if we were located somewhere with scarce water, we're certain that the new cooler would provide a significant fiscal and environmental improvement. We've also found that having the cooling tower off for half the year affords us plenty of time to conduct maintenance on the open-loop system." BP

About the Authors

Mihir Kalyani is the Assistant Manager of EVAPCO's Dry & Adiabatic Cooler product line. Mihir has been at EVAPCO since 2014 and is a mechanical engineer from the University of Maryland in College Park, Maryland.

About EVAPCO

EVAPCO, Inc. is an industry leading manufacturing company with global resources and solutions for worldwide heat transfer applications. We are dedicated to designing and manufacturing the highest quality products for the evaporative cooling and industrial refrigeration markets around the globe.

Our worldwide clients are supported through our manufacturing facilities and sales offices strategically located around the world. Headquartered in Taneytown, Maryland, EVAPCO products are engineered and manufactured in 25 locations in 10 countries and supplied through a sales network of more than 170 offices. For more information, visit www.evapco.com.

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COOLING TOWERS & CHILLERS

Taking Heat From THE BAKING INDUSTRY

By Zane C. Baker and Shinji "Tak" Takahashi,
SMC Corporation of America

Industrial automation and process applications requiring a chiller or heat exchanger can come in all types of shapes and sizes, and cooling capacity demands can range from a few hundred Btu/hr. for bench top lab equipment to many million Btu/hr. for laser applications.

Chiller sizing for large-scale end users such as beverage, chemical or plastics manufacturing usually will demand central systems to achieve the massive cooling capacity requirements compared with small- to medium-range point of use automation applications. These unique differences become more challenging for original equipment manufacturers (OEMs) as machine designers must anticipate a wide range of end-user operating environments and operator skill levels when specifying chillers or heat exchangers in contrast to end-user facilities where cooling capacity requirements

"Through our R&D phase and our plant testing, we determined that controlling the temperature of the glaze was critical to achieve the required spray pattern and extend the runtime of the glaze sprayer equipment."

— Brian Risch, Director of Operations, Burford Corporation

are location specific and operator skill levels are known.

Burford Corporation, a baking equipment OEM, had to undergo this learning path so they reached out to SMC Corporation of America, an automation components manufacturer, for help in improving machine performance in their spray applicators used to enhance the browning process of hamburger buns prior to the baking.

Burford Corporation's spray applicators are used to enhance the browning process of hamburger buns before baking.

Practical Solutions Through Innovation

Burford Corporation, Maysville, Oklahoma, a division of Middleby since 2017, was founded in 1961 and has been a trusted brand in industrial baking of hamburger, hot dog and hoagie buns for decades. It is the inventor of the Twist Tie machine that seals the bags of bread loaves; they have since expanded their product offerings to seed topping applicators, pan oilers, pan shakers, splitting and dough imprinting equipment, as well as spraying and glazing equipment.

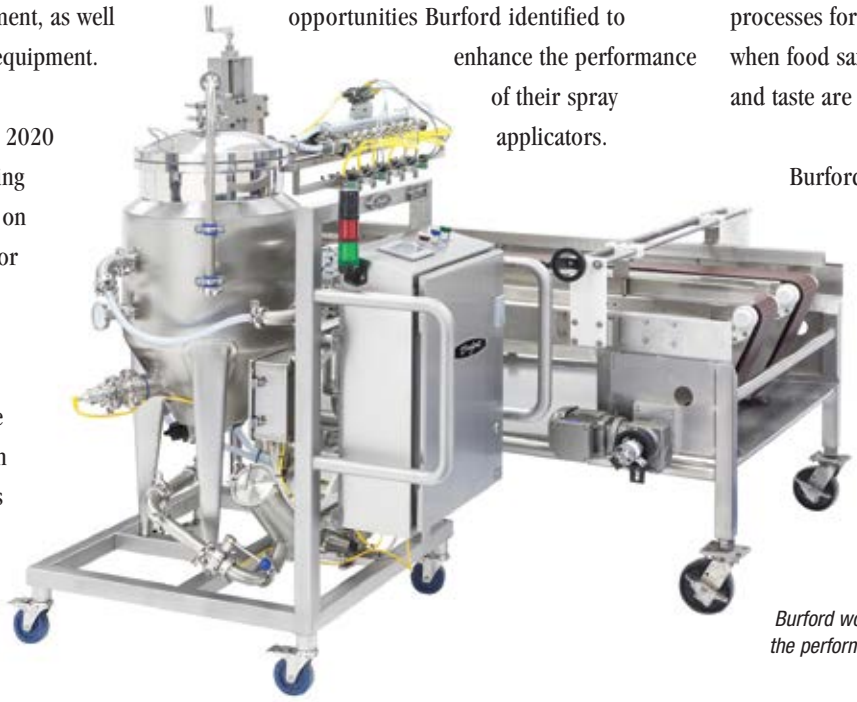
Burford® was awarded a 2020 American Society of Baking (ASB) Innovation Award on Operational Excellence for its Smart Pattern Splitter that uses low-pressure water which replaced cutting knives to split the top of bakery products in a wide variety of patterns controlled by a servo motor before the baking process. This innovation not only enhanced operator safety, it also dramatically increased the versatility of the designs on the bakery products at the touch of a screen in a matter of seconds.

With this commitment to product innovation and customer satisfaction, Burford's Director of Operations, Brian Risch, reached out to Grant Blood at SMC to consult on opportunities Burford identified to enhance the performance of their spray applicators.

Spray Applicators for Industrial Baking

As any home baker will know, before bread dough is baked, the top side will usually be brushed with an egg wash, a thin coat of milk, honey or butter in order to create an appetizing brown coloring and crunchy crust. In industrial baking settings, automation is adopted as a sensible alternative to manual processes for attaining higher throughput when food safety, operator safety, quality and taste are not compromised.

Burford's spray applicator is an integral building block to the baking automation process by accurately spraying a coating or glaze on the top of each hamburger bun, positioned inside of large baking trays as they travel along on a high-speed conveyor before entering an industrial oven.



Burford worked with SMC to enhance the performance of its spray applicator.

TAKING HEAT FROM THE BAKING INDUSTRY

The glazes are usually an end-user proprietary blend or a third party supplied pre-mix, and not manufactured by Burford; placing the machine designers in the dark and causing them to speculate on the glaze ingredients passing through the applicators. A recurring comment from end-user bakeries was how the applicator's spray nozzles became gummed up resulting in costly downtime for cleaning or replacing.

Diagnosing how to extend the cleaning cycles of the spray nozzles and reduce downtime, Risch learned the glazes were always some variety of ingredients blended together into an emulsion. He and his team concluded that over time the emulsions were separating into two parts, a top oily/fatty layer and a bottom layer of liquid.

Emulsions can be partially stabilized by adding an emulsifier, an agent that contains both oil-like and water-like properties to help temporarily bind the emulsion together. However, as time elapses the two layers will naturally begin to separate. In the case of the spray applicators, the only controllable factor remaining for delaying the separation phase of the glaze was temperature stability. Viscosity or the measure of a fluid's resistance to flow is a factor of temperature, and as a fluid's temperature rises, its viscosity decreases and flows faster. Conversely, as the same fluid's temperature is lowered, its viscosity increases and flows slower.

The solution Risch and his team determined would be to lower the temperature of the emulsion inside the applicator's storage tank, hold that temperature, and delay the oily/fatty substance and liquid solution from separating while extending the glaze's useable shelf life. The next challenge was to assess in what kinds of conditions the spray applicators would be operating at the countless end-user baking facilities globally. What would the ambient temperature be? What kind of emulsion would be sprayed etc.? As an OEM machine builder,

Burford engineers would have to correctly gauge the "sweet spot" for all variables of its customers as well as the upper and lower limits of that range. Now, Burford needed a process to control glaze temperature.

Chillers for Enhancing Spray Applicator Performance

To gain insight about chillers, and how to specify and size them for the spray applicators, Risch reached out to SMC and learned about the company's no-obligation Chiller Sample Evaluation Program. After initially sizing a chiller, a customer can use the program to try out the selected unit for the application and evaluate the chiller's cooling capacity performance for up to 45 days. The customer can then upsize, downsize or validate the sample chiller was the most appropriately sized unit. After cooling capacity is confirmed, the next steps to chiller selection are to factor in whether the operating environment has access to facility water, available power supply, ambient temperature, available floor space, and other space constraints.

Since adding a chiller to Burford baking equipment was new territory for Risch's team, Blood worked with the engineers to brainstorm the typical industrial baking environment and list their access to resources.

- Access to facility water? Not guaranteed, so an air-cooled chiller would be best.
- Power supply? Not an issue since SMC chillers are designed to be compatible globally, therefore standard models are 100 VAC (50/60Hz), 115 VAC (60 Hz) or 200 to 230 VAC (50/60 Hz) covering most industrialized economies.
- Ambient temperature inside industrial bakeries? A moving target. Therefore, SMC would recommend the spray applicator and chiller be positioned as far upstream from the ovens as the baking process would allow.
- Available floor space and other space constraints? Unknowable, therefore, the smaller in dimensions the better.

Next, Risch and his team debated what temperature to target for the chiller's setpoint for improving the emulsion's thermal stability. They did not take this discussion lightly knowing at lower temperatures the glaze would have longer shelf life but with tradeoffs of ranging from becoming thicker and gooier to potentially negatively affecting how it sprayed on the dough. They decided to set the upper limit at room temperature 67°F (19.5°C), as this was the glaze manufacturers recommended and the lower limit at just above freezing. Testing would reveal at what temperature range was the "Goldilocks Zone."

Chiller Sample Evaluation Program

Based on the application at Burford, SMC's Chiller and Dryer Group selected an air cooled, mid-range 3.0 kW (10,000 btu) with thermal stability ± 0.18°F (± 0.1°C) from the company's HRS Series of chillers for evaluation. The test chiller arrived at Burford's Research and Development Department a few days later. Risch was initially concerned.

"I can't use this, it isn't made from stainless steel and the enclosure protection won't hold up in a flour dusty baking environment," Risch said. However, Blood reassured Risch the guts of the test unit, including the refrigeration compressor, condenser, evaporator, recirculating pump and temperature sensor, were all identical to a soon-to-be-released environmentally resistant model that would address all of those concerns. He made a case for testing the proof of concept in a lab setting to evaluate chiller sizing, cooling capacity and to observe how the relationship of lowering the temperature of a typical glaze would affect its fluidity and how it would spray in Burford's equipment.

SMC's HRS-R chiller helps Burford's spray applicator maintain the proper temperature of any given glaze applied to hamburger buns.

After hearing more about the chiller, Risch decided to test the HRS. Based on his longtime relationship with Blood, he knew he could count on SMC to deliver the stainless steel

TAKING HEAT FROM THE BAKING INDUSTRY

Features of the SMC HRS-R chiller include a stainless steel cover and electrical box rated IP54 for dust and water splash protection, as well as IP67-rated electrical cable entries.

model in time for the International Baking Industry Exposition (IBIE). Blood also promised Burford President, Clay Miller, the environmentally resistant HRS-R version would arrive in time for IBIE.

New Spray Applicator a Success

The test HRS chiller integrated well with the spray applicator's cooling system, which features a water-jacketed dual-layer tank. The tank is comprised of an inner 20-gallon tank storing the glaze and an outer jacket housing the cooling media (ethylene glycol R410A) to dissipate the heat and stabilize the temperature of the glaze in the inner tank.

The continuous stream of data from testing assured Risch and his team their thermal stability idea was the practical and innovative solution they were looking for.

"Through our R&D phase and our plant testing, we determined that controlling the temperature of the glaze was critical to achieve the required spray pattern and extend the runtime of the glaze sprayer equipment," Risch said.

The HRS not only performed well but it also met the need to consume very little floor space, which is highly valued in bakeries of any size. The HRS has a smaller footprint since it is only 15 inches wide by 20 inches long, yet it delivers equal cooling capacity to larger competitive chillers. The robust HRS-R is also engineered with a stainless steel cover and electrical box rated IP54 for dust and water splash protection. Additionally, all electrical cable entries are rated IP67.

Burford's launch of the new spray applicator at industry event proved to be a success based on orders for units equipped with the HRS-R chiller option. Many at the company's booth at IBIE appreciated the chiller's simple control panel featuring separate current temperature and set temperature displays combined with upward and downward arrows for temperature adjustment.

"The chiller sample program is really the reason we ended up using SMC," Risch said. "Their development of the increased environmental protection version and willingness to provide a unit for testing was a real advantage." BP

About the Authors

Zane C. Baker, SMC America's National Product Sales Manager, has been working in a sales capacity at SMC for 27 years in Marketing, Life Sciences, Product Sales Specialist and currently managing a team dedicated to chillers and dryers at a national level, Email: zbaker@smcusa.com.

Shinji "Tak" Takahashi has been working in SMC Marketing for 15 years, focusing on product development and product promotion.

About SMC Corporation of America

SMC Corporation of America is headquartered in Noblesville, Indiana, and is a subsidiary of SMC Corporation in Japan. SMC Corporation is the world's largest pneumatics company dedicated to factory automation with technical development centers in Japan, the United States, Europe and China. There are 26 sales offices in the United States and five sales offices in Canada supported by domestic engineering, manufacturing and inventory located in Noblesville. To learn more, visit www.smcusa.com.

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- Retrofit cooling towers to reduce water consumption
- Improve water treatment strategy to reduce water consumption
- Deploy VSD compressor technology to reduce chiller kW consumption
- Reduce demand by replacing water-cooled air compressors with air-cooled
- Identify waste heat sources
- Measure and challenge flow and temperature specifications

"The new chiller has multiple cycling scroll compressors providing 30% energy savings, zero down-time in production and remote monitoring for all KPI's."

— Derrick Gough, Coppertail Brewing Co. (feature article in March 2019 Issue)

"We have invested heavily in water treatment. Our Water Saver technology can save clients an immense amount of water and decrease the amount of treatment chemicals."

— Dustin Cohick and Josh Boehner, EVAPCO (feature article in May 2019 Issue)

"Adsorption chillers use water as the refrigerant for zero ODP/ GWP and are driven by waste heat or low-cost natural gas."

— Rajesh Dixit, Johnson Controls
(feature article in August 2019 Issue)

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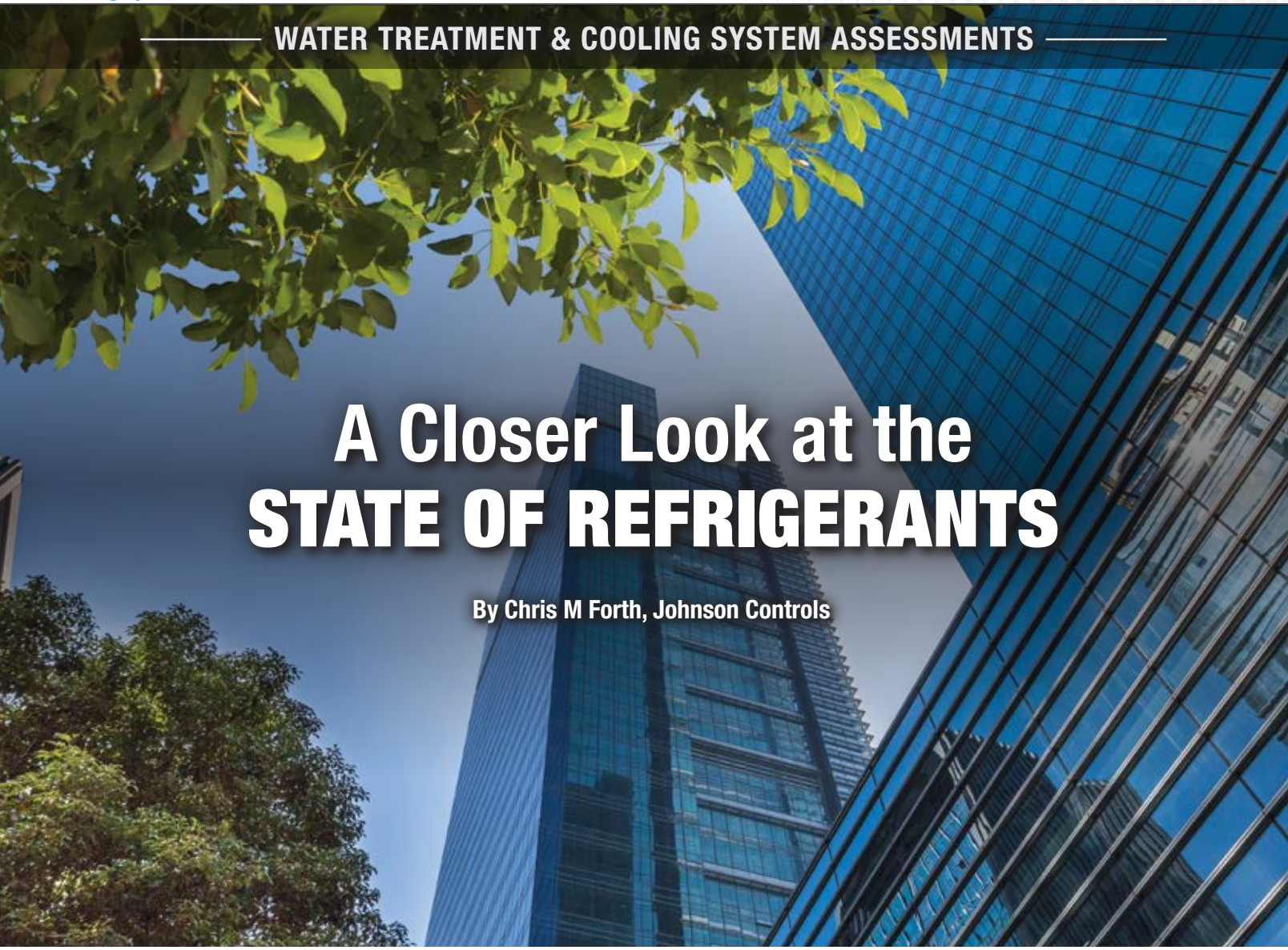


A Closer Look at the STATE OF REFRIGERANTS

By Chris M Forth, Johnson Controls

Recent legislation is impacting the use of hydrofluorocarbon (HFC) refrigerants, both globally and nationally. On the heels of these changes is confusion about legislation and the availability of certain types of refrigerants. On a global scale, the Kigali Amendment to the Montreal Protocol provides a global phase-down schedule for the use of HFC refrigerants in multiple sectors – including R-134a and R-410A – for the HVAC/R industry. While ratified across the globe by approximately 100 countries to date, the amendment has yet to be ratified in the United States.

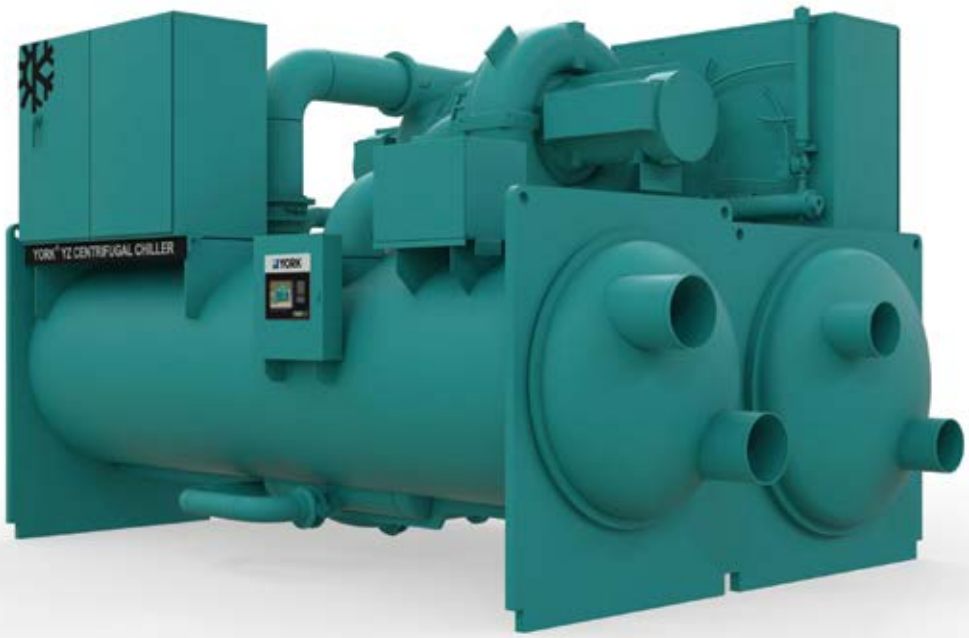
In 2016, the United States Environmental Protection Agency (EPA) put forward rules that banned the sale and installation of many types of commercial refrigeration systems using high global warming refrigerants. However, after litigation, the EPA was told it lacked the authority to tell manufacturers

"Improved operating efficiency reduces the energy used, which lowers indirect emissions that can be responsible for 95% or more of total global warming emissions of a chiller."

— Chris M Forth, Johnson Controls

that had already moved to HFCs that they now had to move away from HFCs. However, most refrigeration equipment manufacturers had already moved forward with engineering low global warming options.

Most regional efforts to reduce the use of refrigerants with higher-GWP (Global Warming Potential) ratings call for a gradual reduction of HFCs rather than a complete phase-out or ban. The U.S. Climate Alliance currently has 24 member states and aims to reduce greenhouse gas emissions by at least at least 26-28 percent below 2005 levels by 2025 in accordance with the Paris Agreement.



Of the utmost importance with a chiller or complete HVAC system is operating efficiency and its ability to consume the lowest amount of energy possible.

States such as California, Washington, New York, and Colorado, as well as several others, are proceeding with their own individual HFC phase-down programs in the absence of the federal SNAP Rules with the majority aligning with the SNAP 20 and 21 sectors. Refrigerants such as R-134a and R-410A continue to be the most widely used refrigerants in the HVAC industry globally, federally, and regionally, but are a key focus of state regulations due to their higher GWP values.

Economics Drives Refrigerant Transitions

Legislation is a factor in refrigerant transitions, but it is not the main factor. Building owners typically transition to new refrigerants when existing equipment becomes too expensive to operate or when the incumbent refrigerant becomes unavailable. A properly maintained chiller can run well past the expected equipment lifetime, regardless of the type of refrigerant used.

HVAC equipment should be replaced when an analysis of new equipment costs versus operating costs provides a good payback scenario or when the refrigerant used in the system is not readily available or becomes too expensive to replace.

After a refrigerant is completely banned by legislation, a limited supply often continues to be produced for servicing. The Montreal Protocol allowed a 10-year service tail for hydrochlorofluorocarbon (HCFC) refrigerants R-22 and R-123 after they were banned from production in new equipment sales. When the service tail production ends the only remaining refrigerant sources are reclaimed and recycled refrigerant from existing equipment. It is critical that all recycled refrigerant is reprocessed back to its original specifications by a reputable reclaimer before being used in a different system.

Cost and Availability Concerns

Refrigerant price varies by availability and by region. Service tail production is limited in quantity and availability which typically causes the refrigerant price to increase as the service tail allowance runs out. New low-GWP refrigerant alternatives are typically more expensive than the incumbent, higher GWP refrigerants. Many lower-GWP alternatives are globally applied and available, but some have very limited production and use.

The Kigali Amendment proposes a partial phase-down schedule for HFC refrigerants, not a total ban. There is no legislation in any region that completely bans the use or

A CLOSER LOOK AT THE STATE OF REFRIGERANTS

production of R-134a or R-410A. In addition, R-134a and R-410A refrigerants currently do not have to be converted to lower-GWP alternatives and chillers utilizing R-134a and R-410A do not have to be replaced with lower-GWP alternatives. To date, servicing of existing equipment is also not affected by global or federal legislation but could be considered in future regulations if reduction commitments are not being achieved.

Evaluating Total System Emissions

Almost all greenhouse gas emissions attributed to HVAC systems are from the carbon dioxide (CO_2) released into the environment during the production of electrical power that is used to run the chiller. It is imperative to focus on the operating efficiency of a HVAC system and the guarantee that it consumes the lowest amount of energy possible, rather than focusing solely on the refrigerant properties.

GWP quantifies the amount of global warming equivalence a refrigerant has when compared to CO_2. Refrigerant GWP can be evaluated with the emissions generated from consumed energy for a complete view of environmental impact. Calculating the total equivalent warming impact (TEWI) involves totaling the chiller's direct and indirect emissions. Indirect emissions are defined as the CO_2 emissions from the energy generated to operate a chiller, while direct emissions are refrigerant emissions from possible refrigerant leakage, maintenance and end-of-life refrigerant recovery.

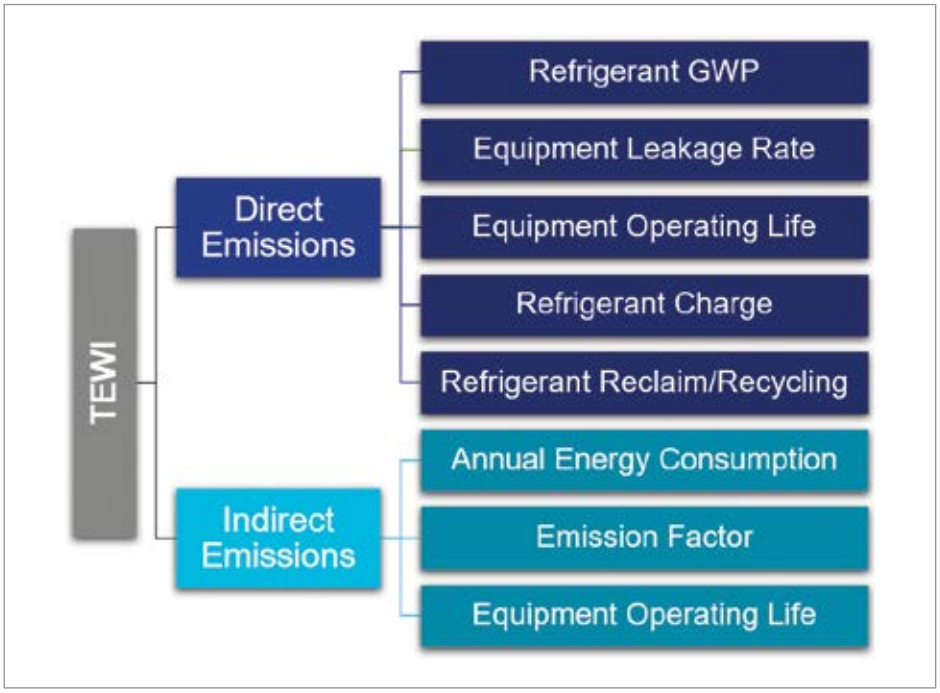
Emissions however do vary by sector and product. Direct-emitting applications such as aerosols and foams release refrigerant gas with every use. Automobiles tend to have higher refrigerant leakage rates due to the bumpy and constant motion of a vehicle. Stationary chillers are engineered to have very low or zero refrigerant leakage rates, and with proper maintenance and end-of-life recovery processes, chillers will have almost no direct refrigerant impact to the environment.

Refrigerant gas can only directly impact the environment if it is released into the earth's atmosphere. Non-emitting systems – such as chillers – should not be limited to low-GWP refrigerant alternatives that cause the system operation to be less efficient. Chiller operating efficiency greatly outweighs refrigerant GWP effects on the environment and small improvements in equipment efficiency can negate potential direct refrigerant emissions. The ultimate goal is to select refrigerants that allow for the highest overall system efficiency with a lower GWP.

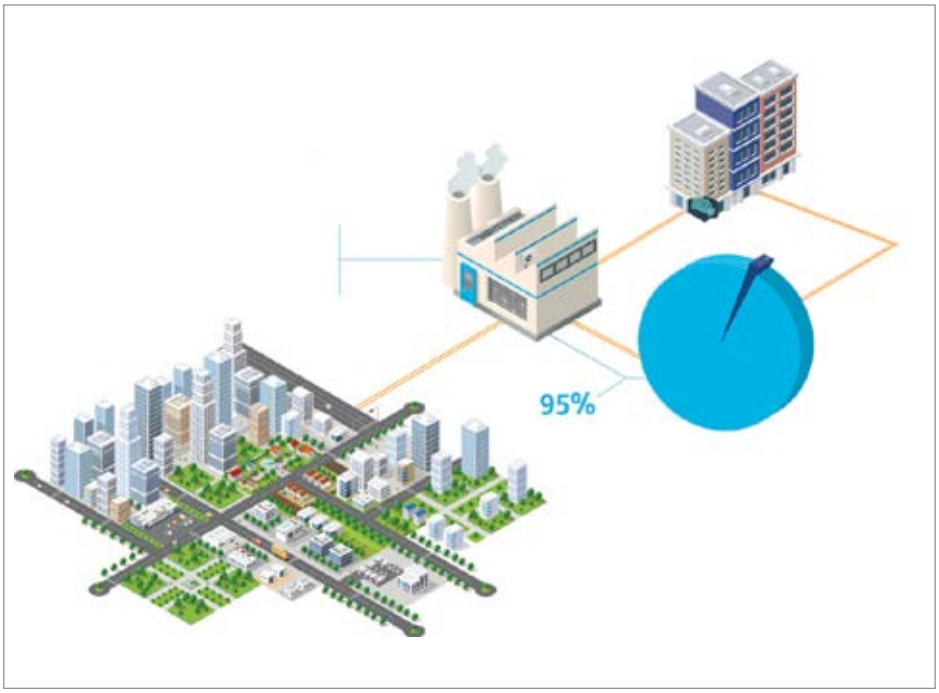
Considerations when Selecting a Refrigerant

There are several important factors to consider when selecting a new hydrofluoroolefin (HFO), low-GWP refrigerant. Some of the recently introduced HFC alternatives were released only in limited quantities or – in some markets – not at all. The challenge is understandable since it takes time for production to ramp up and for supply chains to be established. However, this lack of availability creates risk for technicians and building owners.

Efficiency and reliability are also extremely important. Improved operating efficiency reduces the energy used, which lowers indirect emissions that can be responsible for 95% or more of total global warming emissions of a chiller. A secondary advantage is the reduction of the quantity of refrigerant. One of the most



Total Equivalent Warming Impact (TEWI) is calculated by combining the direct and indirect greenhouse gas emissions from operating a chiller.



Indirect emissions due to energy consumption account for almost all greenhouse gas emissions from a chiller.

critical aspects of refrigerant selection is safety. The flammability and toxicity of a refrigerant must also be considered. For example, a new refrigerant might appear to be acceptable based on GWP and availability, but its toxicity classification may make it unacceptable for specific applications.

The Long View of New Refrigerants

Each refrigerant transition introduces new challenges for HVAC/R owners and facility maintenance staff. Evaluating the economic implications of new refrigerant alternatives is a major focus for current and future technology developments.

Energy consumption of HVAC/R systems has the greatest impact on operational cost – it is typically more expensive than the installation and first cost of system equipment. Purchasing energy-efficient equipment with potentially higher first cost can often be offset by continued operational savings over the lifetime of the system. Payback analysis is available to compare a wide range of system efficiencies and equipment types.

New refrigerants must also provide long-term HVAC/R solutions that avoid premature obsolescence of large capital investments. Competitive refrigerant technologies encourage continued growth in the HVAC industry and multiple supply chains are ultimately required to support the end-user's aftermarket needs. BP

About the Author

Chris M. Forth is Executive Director of Regulatory, Codes and Environmental Affairs, Johnson Controls, and leads the regulatory, codes and environmental affairs for the Johnson Controls Ducted Systems (Unitary) business. Forth has worked in the HVAC industry for 30 years serving in various capacities including design and product engineering as well as product management. For the last several years he has been dedicated to regulatory issues and has been leading efforts on the transition to low GWP refrigerants in individual states as well as at the federal level. He has also worked on other initiatives such as the pending 2023 DOE efficiency transition for unitary products and California's Ultra Low NOx regulations for gas furnace emissions. Forth can be reached via LinkedIn @ Chris Forth.

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