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# FROM THE EDITOR

A significant effort by The Cooling Technology Institute (CTI) to help owner-operators and engineering firms with quality assurance is described in our lead article written by Associate Content Manager Bill Smith titled, "CTI Standard 201: Certifying Thermal Performance of Heat Rejection Equipment." Every engineering firm designing in compliance with ASHRAE 90.1 Energy Standard for Buildings should be familiar with the CTI STD-401 standardized 49-point disclosure tables representing heat rejection capabilities, or constant duty points, for different fan horsepower sizes in the product range (see page 20).

Festo Corporation is responding to customer demand to increase the sustainability of their automated manufacturing processes. Smart pneumatics is the term they use for the techniques Festo deploys to save energy by reducing compressed air use (flow) and pressure requirements. Our own Mike Grennier interviewed Festo experts in his article, "Festo Smart Pneumatics and AI Solutions Spur Gains Toward Sustainability."

Should your cooling system be using a storage tank? To answer this question, Clayton Penhallegon, Jr., provides engineers with an informative and educational article titled, "Tank Applications in Central Cooling Systems Part 1 – To Be or Not to Be."

Does your plant use carbon dioxide and nitrogen in the manufacturing process? The use of both is the brewing industry is widespread. We thank Garrett Rinker, from South-Tek Systems for his article titled, "On-Premises Nitrogen Generation Addresses Carbon Dioxide Supply Concerns for Brewers."

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



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# Compressed Air Technology & Industry News

## Kaeser's Compressor for a Cure Raises Over $20,000

Kaeser Compressors, Inc.'s Compressor for a Cure has raised over $20,000 for the Breast Cancer Research Foundation. While many companies use October to increase awareness for Breast Cancer screening and prevention, Kaeser believes that what we really need is research to find a cure! Accordingly, Kaeser auctioned off a one-of-a-kind M59PE portable unit – calling it our "Compressor for a Cure."

The auction began on National Mammogram Day, October 21st and concluded on October 31st with 25 bids raising $21,700 which will be added to individual employee donations for a total of $23,120! Kaeser will donate 100% of the proceeds. "While great strides have been made, too many of our family members and friends are still impacted by breast cancer," said Frank Mueller, President of Kaeser Compressors, Inc. "We believe meaningful progress towards a cure can be made with more funding for research and want to be part of that effort."

Breast Cancer is the most common cancer in women worldwide with approximately 2.3 million women diagnosed in 2021. It is the second leading cause of cancer death in American women, and tragically, incidence rates are on the rise. For more information on how you can contribute to breast cancer research, please visit bcrf.org. For more information on Kaeser's efforts in our community and our shared environment, visit us.kaeser.com/goyellowbegreen.

### *About Kaeser Compressors*

*Kaeser Compressors is a leader in reliable, energy efficient compressed air equipment and system design. We offer a complete line of superior quality industrial air compressors as well as dryers, filters, SmartPipe™, master controls, and other system accessories. Kaeser also offers blowers, vacuum pumps, and portable gasoline and diesel screw compressors. Our national service network provides installation, rentals, maintenance, repair, and system audits. Kaeser is an ENERGY STAR Partner. For more information, visit us https://us.kaeser.com/.*


*Kaeser's pink M59PE auction raises over $20,000 for Breast Cancer Research Foundation.*

## Atlas Copco Acquires Aircel

Atlas Copco has acquired Aircel, LLC., a US-based provider of air treatment and air purification solutions.

Aircel is a privately owned company headquartered in Maryville, Tennessee in the US. The company has 19 employees and had revenues of MUSD 6.4 (around MSEK 55*) in 2021.

Aircel focuses on the production and sales of air treatment and air purification equipment, including desiccant and refrigerant dryers, filtration, and condensate equipment. The company serves a wide range of industries such as food and beverage, automotive, medical and dental, aviation, pharmaceutical, electronics, energy, and petrochemicals.

"Aircel is a reputable company in the air treatment and air purification market, which makes it a good fit for us," said Vagner Rego, Business Area President Compressor Technique. "Their expertise and product portfolio will increase our market presence and further accelerate our business development in North America."

The purchase price is not disclosed. The company will become part of the Industrial Air division within the Compressor Technique Business Area.

### *About Atlas Copco Group*

*Great ideas accelerate innovation. At Atlas Copco we have been turning industrial ideas into business-critical benefits since 1873. By listening to our customers and knowing their needs, we deliver value and innovate with the future in mind. In 2021, Atlas Copco had revenues of BSEK 111 and at year end about 43 000 employees. For more information, visit www.atlascopcogroup.com.*

*Based on the average exchange rate in 2021.

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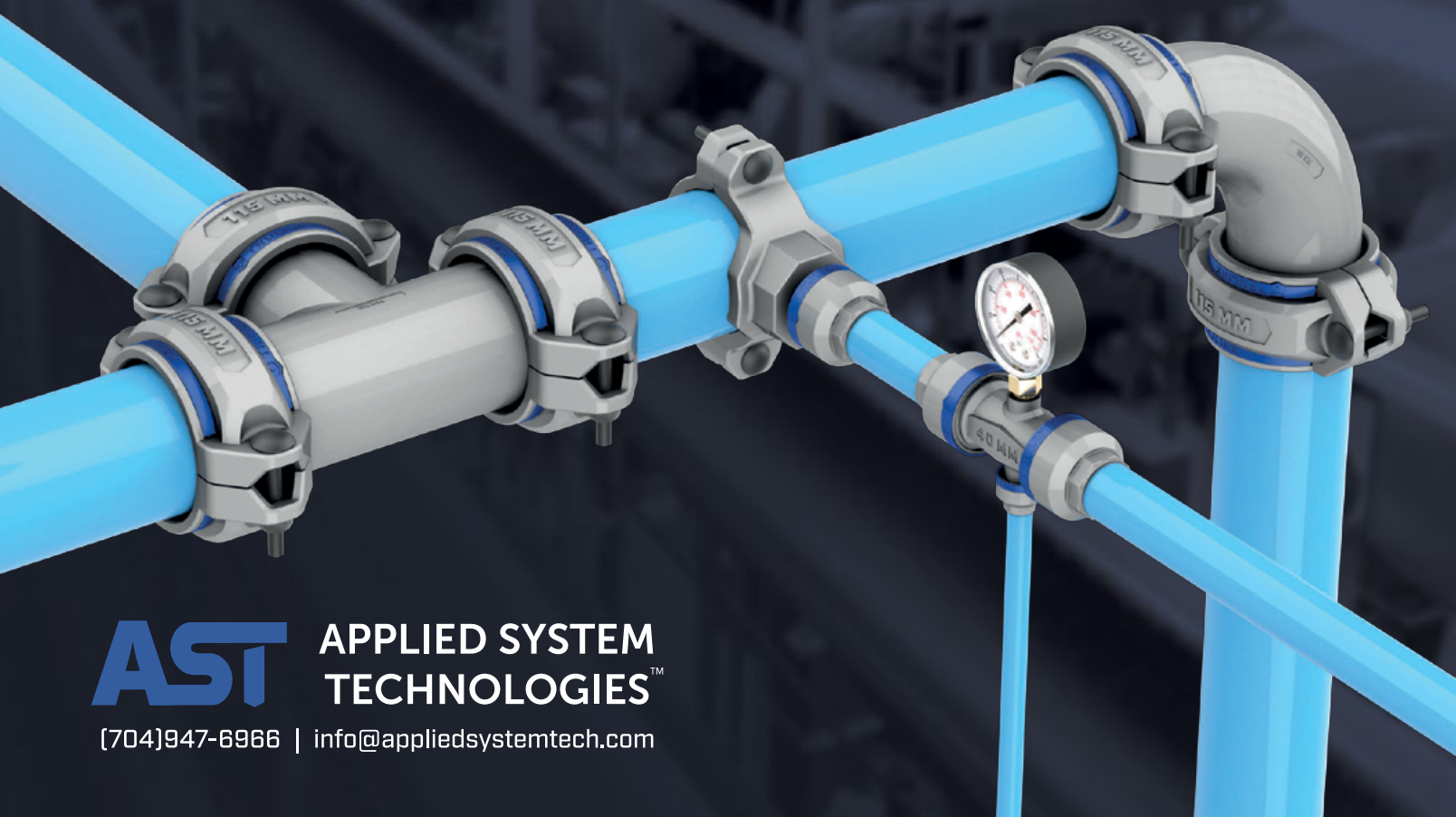


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## Compressed Air Technology & Industry News

### Joe Beyer Joins Sullair as Senior Vice President Sales

Sullair, an industry leader in innovative compressed air solutions since 1965, announced that Joe Beyer has joined the company as Senior Vice President Sales, North America, effective January 3, 2023. Beyer will be responsible for directing and growing the Company's North American stationary sales division, while implementing a customer focused, solutions forward go-to-market strategy.

"Joe Beyer is a proven strategic thinker and leader," said John Randall, Sullair President and CEO. "He brings a change mindset and will play a key role in driving our strategy to build a more modern, customer-centric business that provides products and solutions for our customers and channel partners."

Beyer brings direct compressor industry experience and more than twenty years industrial sales knowhow in both North America and Asia to the role. Utilizing a servant leader approach, he has been instrumental in developing new sales strategies and cultures that result in significant revenue growth.

"It is an honor to join a company with such a rich legacy as Sullair," said Joe Beyer. "Building on the company's strong foundations, I am looking forward to collaborating with the team and expanding their customer-first approach."

Prior to joining Sullair, Beyer was Vice President Sales MIM&E Extrusion at Milacron, a plastics injection and extrusion molding machine manufacturer in Cincinnati, Ohio. He holds a master's degree in business administration from Ohio State University Fisher College of Business, and a bachelor's degree in mechanical engineering from Ohio University.

*Joe Beyer, Senior Vice President Sales, North America, Sullair.*

*About Sullair*

*Since 1965, Sullair has developed and manufactured air compressors with proven reliability and wear-free durability. Sullair is globally recognized as a leading manufacturer of air compressors for use in manufacturing, oil and gas operations, food processing, construction and more. Sullair has manufacturing capabilities in Michigan City, Indiana; Suzhou, China; and a JV (IHI-Sullair) based in Suzhou. For more information, visit www.sullair.com. Sullair is a Hitachi Group Company.*

## Lupamat Compressor Partners with FS-Elliott

Lupamat Compressor has signed a partnership agreement with FS-Elliott, the American centrifugal air compressor manufacturer based in Export, Pennsylvania. The agreement will aid the development of FS-Elliott centrifugal air compressor business in the Turkish market.

FS-Elliot began manufacturing its oil-free, integrally geared, multi-stage centrifugal air compressors in 1962, and Lupamat Compressor began production six years later in 1968. With over 100 years of combined experience in manufacturing, sales and service of industrial air compressors, Lupamat and FS-Elliot are positioned to expand its business in the Turkish compressed air market with this agreement.

*About Lupamat Compressor*

*Lupamat, part of Dirinler Industrial Group (DIG), has been a pioneer in the compressed air industry for over 54 years. Lupamat has made great progress in product quality thanks in part to cooperation with its sister companies Dirinler Makina, Dirinler Sanayi Makinaları and Dirinler Döküm, who manufacturer CNC machines and cast-iron production equipment. Lupamat has also made great strides in new product development. After opening its new R&D Center in 2018, Lupamat introduced its 20-bar oil-free $CO_2$ compressors for food and beverage manufacturers in Turkey and across the globe. For more information, visit www.lupamat.com.*


*Elvio Pili, Sales Director EMEA, FS-Elliott and A.Can Dirin, General Manager, Lupamat Compressor (left to right)*

## Quincy Compressor Awarded 2022 Best Companies to Work for

Quincy Compressor was recently named as one of the Best Companies to Work for in Alabama. This annual program is in its thirteenth year – created by Business Alabama magazine and Best Companies Group.

This survey and awards program was designed to identify, recognize, and honor the best employers in Alabama, benefiting the economy, workforce, and businesses.

To be considered for participation, companies had to fulfill the following eligibility requirements:

- Be a for-profit or not-for-profit business or government entity
- Be a publicly or privately held business
- Have a facility in Alabama
- Have at least 15 employees in Alabama
- Be in business a minimum of 1 year

Companies from across the state entered the two-part survey process to determine the Best

## Compressed Air Technology & Industry News

Companies to Work for in Alabama. The first part consisted of evaluating each nominated company's workplace policies, practices, philosophy, systems, and demographics. This part of the process was worth approximately 25% of the total evaluation. The second part consisted of an employee survey to measure the employee experience. This part of the process was worth approximately 75% of the total evaluation. The combined scores determined the top companies and the final rankings. Best Companies Group managed the overall registration and survey process in Alabama, analyzed the data, and determined the final rankings.


*Quincy Compressor was named as one of the Best Companies to Work for in Alabama.*

An awards event was held December 1, 2022, at the B&A Warehouse in the Parkside District of Birmingham, AL.

For more information about Quincy Compressor and current job openings, please visit www.quincycompressor.com.



Headquartered in Bay Minette, Alabama, Quincy Compressor is a leading designer and manufacturer of reciprocating and rotary screw air compressors, vacuum pumps and a full line of air treatment components. Quincy has more than 600 employees worldwide, and its products are sold through multiple channels, including a network of distributors, commercial retailers, online and company-owned stores.

*About Quincy Compressor*

*Quincy Compressor is a leading designer and manufacturer of reciprocating and rotary screw air compressors, vacuum pumps and a full line of air treatment components. In business since 1920, Quincy has built its reputation on quality and rugged reliability, building tough air compressors for the most demanding applications. The Quincy brand is synonymous with quality, delivering "Performance You Demand. Reliability You Trust." Quincy's dedicated network of authorized distributors offers top-notch installation and after-sales services for reliable, efficient air year after year. To learn more and locate an authorized dealer, visit www.quincycompressor.com*

### FS-Curtis Launches the New iCommand Touch Plus

FS-Curtis announced the launch of the next generation of compressor controllers: the iCommand-Touch+. Compared to the previous iCommand-Touch controller, the iCommand-Touch+ helps optimize performance, save energy, limit downtime, and save money.

This new controller delivers improved flexibility and functionality via a simple HMI touchscreen. The 7" full-color screen displays real-time information about compressor operating parameters, making

troubleshooting a breeze. Variable Frequency Drive data is now conveniently displayed on the iCommand-Touch+ touchscreen to speed up issue resolution. Default access codes for the iCommand Touch+ can be password protected to prevent unwanted setting changes.

Additionally, iCommand-Touch+ has important features such as auto restart, operating mode selection, dryer function monitoring (units equipped with integral dryer), sequence control of up to 6 FS-Curtis air compressors, and a calendar/time-based system operating schedule. The screen displays real-time and historical data trends, helping you monitor the pulse of your compressed air system.

FS-Curtis is excited to share innovative technologies and world-class products. With our employees and quality-focused manufacturing, FS-Curtis will remain a trusted and dependable name in compressed air.

For more on iCommand-Touch+, visit https://us.fscurtis.com/product/icommand-touch-controller/ or contact an authorized FS-Curtis channel partner at https://us.fscurtis.com/support/distributor-finder/ today.

*About FS-Curtis*

*FS-Curtis is committed to offering a world-class portfolio of products. Through the dependability of our people and our quality-focused manufacturing, FS-Curtis will continue to be the most trusted and dependable name in compressed air serving even more markets trusted and dependable name in compressed air serving even more markets through our ever-growing global presence. For more information find us online at www.fscurtis.com.*


*The New iCommand Touch+ from FS-Curtis.*

## Compressed Air Technology & Industry News

### Suburban Manufacturing Breaks Ground on Expansion

Suburban Manufacturing Group (SMG) broke ground for the company's new 21,400 square foot expansion. The addition will join the existing 40,300 square foot facility located in Monticello, Minnesota.

This expansion allows SMG to broaden their manufacturing capabilities with a continued investment in the newest technology across the machining, sewing, and assembly divisions.

Suburban Manufacturing's CEO, Chase Marshall, said, "We're focusing on automation and vertical integration to support the domestic and international growth for Tsunami, Python, and LubeMinder products."

*Todd Lorsung, CFO, Rick Barger, COO, Mary Barger & Brad Barger, Founders & Board Members, and Chase Marshall, CEO (left to right).*

The expansion is scheduled to be completed spring 2023 and will provide the necessary space to grow the custom sewing, assembly, and machining departments. A section of the new space will also be allocated for inventory to stay consistent with their philosophy of reduced lead times.

"Upon completion, we'll also be taking advantage of the opportunity to improve our stock mix to support our large OEM customers," Marshall said.

Negen and Associates, based in St Cloud MN, is the contractor for the highly anticipated project.

Suburban Manufacturing Group, longtime contributor of the local community, continues to grow as a leader in fluid power technology worldwide.

*About Suburban Manufacturing Group*

*Founded in 1979 by Brad and Mary Barger, Suburban Manufacturing's three brands, Tsunami Compressed Air Solutions, Python Covers + Sleeves, and LubeMinder Oil & Grease Systems, continue to lead in the fluid power industries through innovation and collaboration. For more information, visit www.gosuburban.com.*

## ESAB Corporation Acquires Ohio Medical

ESAB Corporation, a world leader in fabrication and gas control technology, announced that it has acquired Ohio Medical, LLC, a global leader in oxygen regulators and central gas systems, from a private investor group for a cash purchase price of $127 million. The Company also expects an additional cash tax benefit with a net present value of $15 million. During twelve months, Ohio Medical generated over $45 million of sales, gross margins above 40%, and adjusted EBITDA margins greater than 20%. The acquisition is expected to be adjusted EPS accretive to ESAB in the first year. The Company financed the acquisition using cash on hand and expects its net leverage ratio to be less than 3x at the end of 2022.

Shyam P. Kambeyanda, President and Chief Executive Officer of ESAB, said, "We are thrilled to welcome the Ohio Medical team to ESAB Corporation. Ohio Medical increases our served market in North America for medical oxygen regulators and central gas systems, complementing our GCE and Victor businesses, creating a gas control equipment leader with revenues of more than $400 million. We are excited about the significant global cross-selling opportunities and how Ohio Medical advances our strategy to drive faster growth, higher margins, lower cyclicality, and stronger cash flow."

Anthony Wieczorek, Chief Executive Officer of Ohio Medical, said, "For more than 100 years, we have been a market leader in oxygen regulators and central gas systems. Joining ESAB will help us accelerate our expansion globally, while allowing us to harness the power of the ESAB Business System (EBX) to better serve our customers with increased efficiency and innovative customer solutions."

Ohio Medical is headquartered in Gurnee, Illinois and employs approximately 100

## Compressed Air Technology & Industry News

associates, providing ESAB with strong brands and distribution in the large and attractive North American market. Combined with ESAB's Victor and GCE businesses, the addition of Ohio Medical creates an unmatched global medical and industrial gas control portfolio that enhances the company's worldwide offerings.

PricewaterhouseCoopers Corporate Finance LLC served as financial adviser and Tucker Ellis LLP served as legal counsel to the Company.

*About ESAB Corporation*

*ESAB Corporation is a world leader in fabrication and gas control technology, providing our partners with advanced equipment, consumables, gas control equipment, robotics, and digital solutions which enable the everyday and extraordinary work that shapes our world. To learn more, visit www.ESABcorporation.com.*

### ELGi Celebrates 10 Years in North America

ELGi North America (ELGi) is celebrating ten years in the U.S. The Charlotte-based company is a subsidiary of ELGi Equipments Limited, one of the world's leading air compressor manufacturers for the last six decades. Since entering the North American Market in 2012, ELGi company has significantly grown its footprint, expanding from coast to coast with several memorable milestones along the way.

ELGi provides air compressors and cutting-edge compressed air solutions to a variety of industries, including manufacturing, food and beverage, pharmaceuticals, construction, and healthcare.

During ELGi's first 10 years in North America, the company has grown significantly through a strategic expansion plan. The company started with only a handful of employees in Charlotte and now has more than 175 employees. ELGi has grown its distribution through acquisitions and joint ventures, relying on strong partnerships to sell its products and support them. So far, the company has helped install more than 10,000 air compressors in facilities across North America.

ELGi's strategy for growth included offering a lifetime air end warranty which was subsequently followed with a five-year complete package warranty, both of which were unprecedented within the North American market. This commitment to product quality and reliability paved its way to becoming the leader in the compressed air market in North America. The company also provides 48-hour Uptime Assurance. This is enabled by ELGi's focus on maintaining healthy stock levels of products and parts, along with its company's flexible, nimble nature that ensures it to quickly serve customer needs.

ELGi has an ambitious vision for the next ten years. The company expects North America to be its largest market, surpassing the extent of its current global footprint. To achieve this goal, ELGi is investing in people, processes, and technologies.

"North America helped us unlock new standards for how a machine should be built. Hence, ELGi opened its own foundry in India and brought the manufacturing of key components in-house, such as castings and air ends, to control product specifications and create best-in-class quality compressors. This means higher uptime in the field," said Anvar Varadaraj, President of ELGi North America. "We are also investing in new business


*ELGi plans to expand further and invest in people, processes, and technologies in the coming years.*

partners by co-founding joint ventures to promote entrepreneurship in air compressor distribution."

ELGi has already seeded five new companies as part of the joint venture program. This includes the co-founding of Pattons of California, Compressed Air Solutions of Texas (CAST), G3 Industrial Solutions, Gentex Air Solutions, and Evergreen Compressed Air and Vacuum.

ELGi also plans to invest in STEM programs for students, replicating the success of an apprentice program the parent company runs in India. The company is sincere in its commitment to expand manufacturing jobs in North America and to grow its talent pool in Charlotte.

"Our goal is to be among the top three compressed air manufacturers globally," Varadaraj said. "To achieve that goal, we need to continue with the momentum ELGi has already established. If the last 10 years have been a preview, we are well on our way to another successful decade."

### *About ELGi North America*

*ELGi North America, headquartered in Charlotte, NC, is a subsidiary of ELGi Equipments Limited, a leader in compressed air solutions for over 60 years. Established in 2012, ELGi North America, in conjunction with its subsidiaries, Pattons, Pattons Medical, and Michigan Air Solutions, offers a comprehensive range of compressed air products and services. Our product offering includes oil-lubricated and oil-free rotary screw and reciprocating compressors, dryers, filters, and ancillary accessories. ELGi and its subsidiaries serve multiple industry verticals spanning medical applications, pharmaceuticals, food & beverage, construction, manufacturing, and infrastructure. For further information, please visit https://www.elgi.com/us/*

## Shanbhag Appointed President of Alkin Compressors

Alkin Compressors has announced the appointment of Nitin G. Shanbhag as President of Alkin Compressors Inc.

*Nitin G. Shanbhag, President, Alkin Compressors*

Shanbhag is a graduate engineer of Clemson University with more than 25 years experience in the compressed air industry having held leadership positions in the areas of Management, Sales, Marketing and Product Development in organizations such as Ingersoll Rand, Hitachi, Boge, and Mikropor. Shanbhag is also an active contributor to the Compressed Air & Gas Institute (CAGI).

"We are very excited for Nitin's addition and leadership to foster growth and increased customer focus in our group companies," stated Ozen Tujumet, CEO, Alkin & Aykom Compressors. "Nitin's experience, ethics and drive to serve customers fits with our core values and we are honored to have him as part of our team."

"I am ecstatic in joining the Alkin & Aykom Group of Companies!! The family has been so welcoming to me," stated Nitin G. Shanbhag, President, Alkin Compressors. "I am so blessed to join this company. I feel that with the great people and our new manufacturing facilities, we are a best kept secret that I am proud to represent. Our vertical integration enables much innovation of air and specialty gas solutions in low, medium and high Pressures to serve a variety of customer needs."

For further information, please contact Alkin Compressors at 973-246-9241 or visit online at www.alkinus.com

### *About Alkin & Aykom Compressors*

*Alkin Compressors Inc., headquartered in Clifton, New Jersey, a subsidiary of the Alkin/Aykom Group companies, offers a broad range of engineered solutions for the compressed air industry such as: High Pressure Breathing Air Compressors, Medium and Low Pressure Air Compressors, High Pressure Boosters, Oil-Free Compressors, Containment Fill Stations, Nitrogen Production Systems, Air Dryers, Filtration, and aftermarket replacement filtration elements for compressed air. Founded in 2015, our Assembly and Distribution center is established to locally serve the Americas customer base of Distribution and OEM partners.*

*Alkin Compressors / Aykom Compressors/Aydin Trafo is headquartered in Izmir, Turkey. Founded over 60 years ago, Aykom Compressors has grown each year with new technology, vertical integration and subsidiaries such as Alkin Compressors to expand our capabilities and portfolio of products. Our group companies specialize in Rotary Screw, Reciprocating and other adjacent product categories serving the Low, Medium and High Pressure Compressed Air and Specialty Gas market segments. We proudly support over 400 employees.*

# CTI Standard 201: Certifying Thermal Performance of Heat Rejection Equipment

By Bill Smith, Associate Content Manager, Chiller & Cooling Best Practices Magazine

*Two Marley® cooling towers installed in St. Louis, Missouri. Image courtesy of SPX Cooling Tech, LLC.*

Facility managers and specifying engineers responsible for a plant or building's cooling equipment operation can be at the mercy of vendors overstating the efficiency of their units. Over- or under-sized systems can cause efficiency losses, underperformance, processes being put at risk, or not meeting demand on a hot day.

Fortunately, there is an organization dating back to the 1950s of owner-operators, suppliers, and cooling tower manufacturers who are testing and certifying the quality and thermal performance of a manufacturer's equipment is in accordance with its published ratings.

This article will explore the Cooling Technology Institute (CTI) Standard 201 (STD-201) Thermal Certification Program, share perspective from leading cooling tower manufacturers, and cover other existing and evolving CTI test codes, standards and certifications. This article will also emphasize the investment and bandwidth contributed to CTI by cooling tower manufacturers for the benefit of the industry and its end users.

## Overview of CTI Thermal Performance Testing & Certification

CTI Standard (STD) 201 certifies all models of a line of evaporative heat rejection equipment offered for sale by a specific manufacturer will perform thermally in accordance with their published ratings. STD-201 has two branches. First, STD-201RS is titled *Performance Rating of Evaporative Heat Rejection Equipment,* and covers testing, ratings and published data

requirements. Secondly, STD-201OM is titled *Operations Manual for Thermal Performance Certification of Evaporative Heat Rejection Equipment,* and monitors compliance with the provisions of STD-201RS.[1]

"Before CTI certification, there was a tendency of vendors to overstate performance of their evaporative heat rejection equipment," said Benjamin Cohen, Manager, Product Marketing – North America, Baltimore Aircoil Company. "Now, all cooling tower manufacturers are on a level playing field."

The Licensed CTI Thermal Certification testing agencies are based in Tennessee, Kansas, Singapore and Germany. CTI's global footprint complements its partnership with Eurovent, Europe's industry association for HVAC, process cooling and food cold chain technologies.

"Most often, representatives from CTI's licensed agencies travel to the manufacturers' site to conduct testing," said Larry Burdick, Director of Technical Services, SPX Cooling Tech, LLC. Mr. Burdick serves as Committee Chair for ATC-105, the thermal test code published by CTI, and Committee Chair for ATC-128, the sound test code for heat rejection equipment.

Field testing can be conducted following CTI's ATC-105 test procedures, however field performance testing a unit under STD-201 at an end user's plant for example, is not practical at times. Challenges of testing at an end user site include providing adequate and stable heat duty for testing, interrupting processes, being in a

# CTI Standard 201: Certifying Thermal Performance of Heat Rejection Equipment

remote location, properly calibrating flow meter readings and instrumentation, or obstructions around the tower. Therefore, testing at a cooling tower manufacturer's dedicated sites using CTI owned and calibrated flow meters and test instrumentation is most common.

STD-201RS limits of certifications are outlined in Figure 1. Testing conditions must be set within these given parameters. As shown, limits of certification are different for cooling towers/ closed circuit coolers, evaporative condensers and dry coolers.

*Rooftop installation of an adiabatic fluid cooler overlooking Paris, France. Image courtesy of EVAPCO.*

For Cooling Towers and Closed-Circuit Coolers:

| | SI Units | IP Units |
|---|---|---|
| Wet Bulb Temperature | 10°C to 32.2°C | 50°F to 90°F |
| Maximum Process Fluid Temperature | 51.7°C | 125°F |
| Minimum Range | 2.2°C | 4°F |
| Minimum Approach | 2.8°C | 5°F |
| Barometric Pressure (Cooling Towers) | 77.8 kPa to 105 kPa | 23 in Hg to 31 in Hg |
| Barometric Pressure (Closed-Circuit Coolers) | 91.4 kPa to 105 kPa | 27 in Hg to 31 in Hg |

For Evaporative Refrigerant Condensers:

| | SI Units | IP Units |
|---|---|---|
| Wet Bulb Temperature | 10°C to 32.2°C | 50°F to 90°F |
| Maximum Condensing Temperature | 43.3°C | 110°F |
| Barometric Pressure | 91.4 kPa to 105 kPa | 27 in Hg to 31 in Hg |

For Dry Coolers:

| | SI Units | IP Units |
|---|---|---|
| Dry Bulb Temperature | 5°C to 50°C | 41°F to 122°F |
| Maximum Process Fluid Temperature | 100°C | 212°F |
| Minimum Range | 2.2°C | 4°F |
| Minimum Approach | 2.8°C | 5°F |
| Barometric Pressure | 91.4 kPa to 105 kPa | 27 in Hg to 31 in Hg |

*Figure 1: CTI STD-201 Limits of Thermal Certification. Image courtesy of the Cooling Technology Institute.*

- Wet bulb temperature (WBT) is defined as the temperature of adiabatic saturation. This is the temperature indicated by a moistened thermometer bulb exposed to the air flow.

- Approach temperature is the cold water temperature minus WBT. Due to cumulative instrument minimum measurement accuracies, anything less than the minimum approach results in a cumulative test error band that is outside of the allowable test tolerance of 5%.[1]

- Range is the hot water temperature minus the cooled water temperature. The minimum allowable instrumentation accuracy for temperature measurement is ±0.10°F (±0.05°C).[1]

- Barometric Pressure, or atmospheric pressure, is the pressure of the atmosphere usually expressed in terms of height of a column of mercury. Barometric pressure drops as altitude increases.

With over one hundred participating manufacturers in the Cooling Technology Institute, testing and certifying each of the tens of thousands of units coming off the production line is not feasible of course.

"We test and certify a unit from each product line in an OEM's CTI-certified portfolio, but we're also testing the OEM's capability to accurately predict cooling capacities of their units," said Mike Womack, the STD-201 Thermal Certification Administrator.

Once a product line is certified, participating cooling tower manufacturers must complete annual reverification tests for each applicable product line to remain involved in the program.

*Crossflow evaporative coolers at a Houston terminal used to reduce system power consumption and process temperatures. Image courtesy of Baltimore Aircoil Company.*

# CTI Standard 201: Certifying Thermal Performance of Heat Rejection Equipment

"Each year, a licensed CTI testing agency visits our labs and retests a unit from each of our cooling tower and fluid cooler lines," said Natasha Rinehart, former CTI Board of Directors, and Manager – Fluid Coolers with EVAPCO. "We then update the Data of Record for our CTI-certified portfolio, 49-point disclosure tables and more. It's an annual commitment to paying labor, program and testing fees to ensure customers have peace of mind when it comes to the thermal performance of our equipment.

"It's a very worthwhile commitment," echoed Jennifer Hamilton, Vice President of CTI, and Vice President – HVAC Product Development with EVAPCO. "Every time we launch a product, it's another unit we must build and test every year. A significant amount of time in our labs is allocated to testing. Our organization has also invested in construction of additional testing labs. We pay a premium to ensure our equipment will perform as stated."

Capacity Represented in Water Flow (gpm)
[1] Water flow above maximum allowed for this model, maximum shown
[2] Performance information not available for these conditions

**Marley Aquatower Cooling Tower Performance at Standard Conditions**

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | HotWater | 67 | 70 | 72 | 72 | 77 | 72 | 75 | 77 | 77 | 82 | 77 | 80 | 82 | 82 | 87 | 82 | 85 |
| | | ColdWater | 57 | 60 | 62 | 57 | 62 | 62 | 65 | 67 | 62 | 67 | 67 | 70 | 72 | 67 | 72 | 72 | 75 |
| | | WetBulb | 50 | 50 | 50 | 50 | 50 | 55 | 55 | 55 | 55 | 55 | 60 | 60 | 60 | 60 | 60 | 65 | 65 |
| Model | Fan HP | | | | | | | | | | | | | | | | | | |
| 490A | 0.33 | | [2] | 17 | 20 | [2] | 15 | [2] | 19 | 23 | [2] | 17 | 16 | 21 | 25 | [2] | 19 | 18 | 24 |
| 490D | 1 | | 15 | 21 | 25 | [2] | 18 | 17 | 24 | 28 | [2] | 21 | 19 | 27 | 32 | [2] | 23 | 22 | 30 |
| 492D | 1 | | 35 | 47 | 56 | 27 | 42 | 39 | 53 | 63 | 30 | 47 | 43 | 59 | 70 | 33 | 52 | 49 | 66 |
| 492G | 2 | | 44 | 60 | 71 | 33 | 52 | 49 | 67 | 80 | 37 | 59 | 55 | 75 | 89 | 42 | 66 | 61 | 84 |
| 493G | 2 | | 57 | 77 | 92 | 44 | 68 | 63 | 86 | 103 | 48 | 76 | 71 | 97 | 115 | 54 | 85 | 79 | 108 |
| 493H | 3 | | 65 | 90 | 107 | 50 | 79 | 73 | 100 | 120 | 56 | 88 | 82 | 112 | 134 | 62 | 99 | 92 | 126 |
| 494G | 2 | | 83 | 111 | 131 | 65 | 99 | 92 | 123 | 145 | 72 | 110 | 103 | 137 | 161 | 80 | 122 | 114 | 153 |
| 494H | 3 | | 93 | 124 | 146 | 73 | 110 | 103 | 138 | 162 | 81 | 122 | 114 | 153 | 180 | 90 | 136 | 128 | 171 |
| 494K | 5 | | [2] | [2] | 174 | [2] | [2] | [2] | 164 | 193 | [2] | [2] | [2] | 183 | 214 | [2] | 162 | [2] | 204 |
| 495K | 4 | | 129 | 174 | 205 | 100 | 154 | 144 | 193 | 227 | 111 | 171 | 160 | 215 | 252 | 125 | 191 | 179 | 239 |
| 495M | 6 | | 147 | 198 | 233 | 114 | 175 | 163 | 219 | 258 | 126 | 195 | 182 | 244 | 287 | 141 | 217 | 203 | 272 |
| 496K | 5 | | 181 | 242 | 284 | 139 | 215 | 201 | 268 | 315 | 155 | 239 | 223 | 298 | 350 | 174 | 266 | 249 | 332 |
| 496M | 7.5 | | 205 | 275 | 323 | 158 | 243 | 227 | 305 | 358 | 176 | 270 | 253 | 339 | 397 | 197 | 301 | 282 | 377 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | HotWater | 87 | 87 | 92 | 87 | 90 | 92 | 92 | 97 | 92 | 95 | 97 | 97 | 102 | 97 | 100 | 102 | 102 |
| | | ColdWater | 77 | 72 | 77 | 77 | 80 | 82 | 77 | 82 | 82 | 85 | 87 | 82 | 87 | 87 | 90 | 92 | 87 |
| | | WetBulb | 65 | 65 | 65 | 70 | 70 | 70 | 70 | 70 | 75 | 75 | 75 | 75 | 75 | 80 | 80 | 80 | 80 |
| Model | Fan HP | | | | | | | | | | | | | | | | | | |
| 490A | 0.33 | | 29 | [2] | 21 | 20 | 27 | 32 | 15 | 24 | 22 | 31 | 36 | 17 | 27 | 25 | 34 | 41 | 19 |
| 490D | 1 | | 36 | 16 | 26 | 24 | 34 | 41 | 19 | 30 | 28 | 39 | 46 | 21 | 34 | 32 | 44 | 53 | 24 |
| 492D | 1 | | 79 | 37 | 58 | 55 | 74 | 88 | 42 | 66 | 61 | 84 | 99 | 47 | 74 | 69 | 94 | 111 | 53 |
| 492G | 2 | | 100 | 47 | 74 | 69 | 95 | 113 | 53 | 84 | 78 | 107 | 126 | 60 | 94 | 88 | 120 | 142 | 68 |
| 493G | 2 | | 129 | 61 | 95 | 89 | 122 | 145 | 68 | 107 | 100 | 137 | 162 | 77 | 121 | 113 | 154 | 183 | 87 |
| 493H | 3 | | 150 | 70 | 111 | 104 | 142 | 169 | 79 | 125 | 117 | 160 | 190 | 90 | 142 | 132 | 181 | 214 | 101 |
| 494G | 2 | | 179 | 90 | 136 | 128 | 170 | 200 | 100 | 152 | 143 | 190 | 223 | 112 | 170 | 160 | 213 | 248 | 126 |
| 494H | 3 | | 200 | 100 | 152 | 143 | 190 | 223 | 112 | 170 | 160 | 213 | 249 | 125 | 190 | 179 | 238 | 277 | 141 |
| 494K | 5 | | 239 | [2] | 181 | 170 | 227 | 266 | [2] | 203 | 191 | 254 | 296 | [2] | 227 | 214 | 283 | 329 | 168 |
| 495K | 4 | | 281 | 139 | 213 | 200 | 268 | 314 | 156 | 239 | 224 | 299 | 351 | 175 | 267 | 251 | 335 | 392 | 197 |
| 495M | 6 | | 320 | 158 | 243 | 227 | 304 | 357 | 177 | 271 | 255 | 340 | 399 | 199 | 304 | 286 | 381 | 445 | 224 |
| 496K | 5 | | 389 | 195 | 296 | 278 | 371 | 434 | 218 | 331 | 311 | 414 | 484 | 244 | 370 | 348 | 462 | 540 | 274 |
| 496M | 7.5 | | 442 | 220 | 336 | 316 | 421 | 492 | 247 | 376 | 353 | 470 | 548 | 277 | 420 | 396 | 524 | 610 | 311 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | HotWater | 107 | 102 | 105 | 107 | 107 | 112 | 107 | 110 | 112 | 112 | 117 | 89.6 | 95 | 98.6 | 98.6 | | |
| | | ColdWater | 92 | 92 | 95 | 97 | 92 | 97 | 97 | 100 | 102 | 97 | 102 | 80.6 | 85 | 89.6 | 89.6 | | |
| | | WetBulb | 80 | 85 | 85 | 85 | 85 | 85 | 90 | 90 | 90 | 90 | 90 | 69.8 | 78 | 80.6 | 82.4 | | |
| Model | Fan HP | | | | | | | | | | | | | | | | | | |
| 490A | 0.33 | | 30 | 28 | 39 | 46 | 22 | 34 | 32 | 44 | 52 | 25 | 39 | 31 | 24 | 34 | 29 | | |
| 490D | 1 | | 39 | 36 | 50 | 60 | 27 | 44 | 41 | 57 | 68 | 31 | 50 | 40 | 30 | 44 | 37 | | |
| 492D | 1 | | 83 | 78 | 106 | 125 | 60 | 94 | 88 | 119 | 140 | 68 | 106 | 86 | 66 | 94 | 81 | | |
| 492G | 2 | | 106 | 100 | 135 | 159 | 77 | 120 | 113 | 152 | 177 | 87 | 135 | 110 | 84 | 120 | 103 | | |
| 493G | 2 | | 137 | 128 | 174 | 205 | 99 | 154 | 145 | 196 | 230 | 112 | 174 | 141 | 108 | 154 | 132 | | |
| 493H | 3 | | 160 | 150 | 203 | 240 | 115 | 180 | 169 | 229 | 268 | 130 | 203 | 165 | 126 | 180 | 155 | | |
| 494G | 2 | | 191 | 180 | 238 | 277 | 141 | 213 | 201 | 265 | 308 | 159 | 238 | 195 | 153 | 212 | 185 | | |
| 494H | 3 | | 213 | 201 | 265 | 309 | 158 | 238 | 225 | 296 | 343 | 178 | 266 | 218 | 171 | 237 | 207 | | |
| 494K | 5 | | 254 | 239 | 315 | 365 | 188 | 284 | 268 | 351 | 405 | 212 | 316 | 260 | 204 | 282 | 246 | | |
| 495K | 4 | | 300 | 282 | 375 | 438 | 222 | 336 | 317 | 420 | 488 | 249 | 376 | 307 | 240 | 334 | 291 | | |
| 495M | 6 | | 341 | 321 | 426 | 495 | 252 | 382 | 360 | 475 | 551 | 284 | 427 | 349 | 273 | 380 | 331 | | |
| 496K | 5 | | 414 | 390 | 517 | 601 | 308 | 464 | 438 | 577 | 668 | 346 | 518 | 424 | 333 | 461 | 402 | | |
| 496M | 7.5 | | 470 | 443 | 585 | 678 | 349 | 525 | 496 | 651 | 752 | 392 | 587 | 481 | 378 | 523 | 456 | | |

*Figure 2: a 49-point cooling tower performance disclosure table for a crossflow cooling tower from a leading manufacturer. A plant manager operating their system at ASHRAE 90.1 standard design conditions (95/85/75°F) requiring 340 GPM for its processes, would select the 6 HP fan size model. Table courtesy of SPX Cooling Tech, LLC.*

## Thermal Performance Reporting and Disclosure

Published thermal ratings of STD-201RS certified cooling towers are available as standardized 49-point disclosure tables presenting the heat rejection capability and gallons per minute (GPM) at 49 different design conditions, or constant duty points, for different fan horsepower (HP) sizes in the product range. With reference to the 49-point table (Figure 2), end users and engineers can specify their design condition (hot water, cold water and wet bulb temperatures) and desired GPM, then the manufacturer selects the model size and HP requirement. The purchaser can then use the published data to verify their capacity can be met – before the sale is finalized. The standard design conditions from ASHRAE 90.1 Energy Standard for Buildings (except low-rise residential buildings) are 95°F hot water, 85°F cold water, 75°F wet bulb (35/29.5/23.9°C). ASHRAE 90.1 requires CTI certification of cooling towers and closed-circuit coolers on all new construction projects.

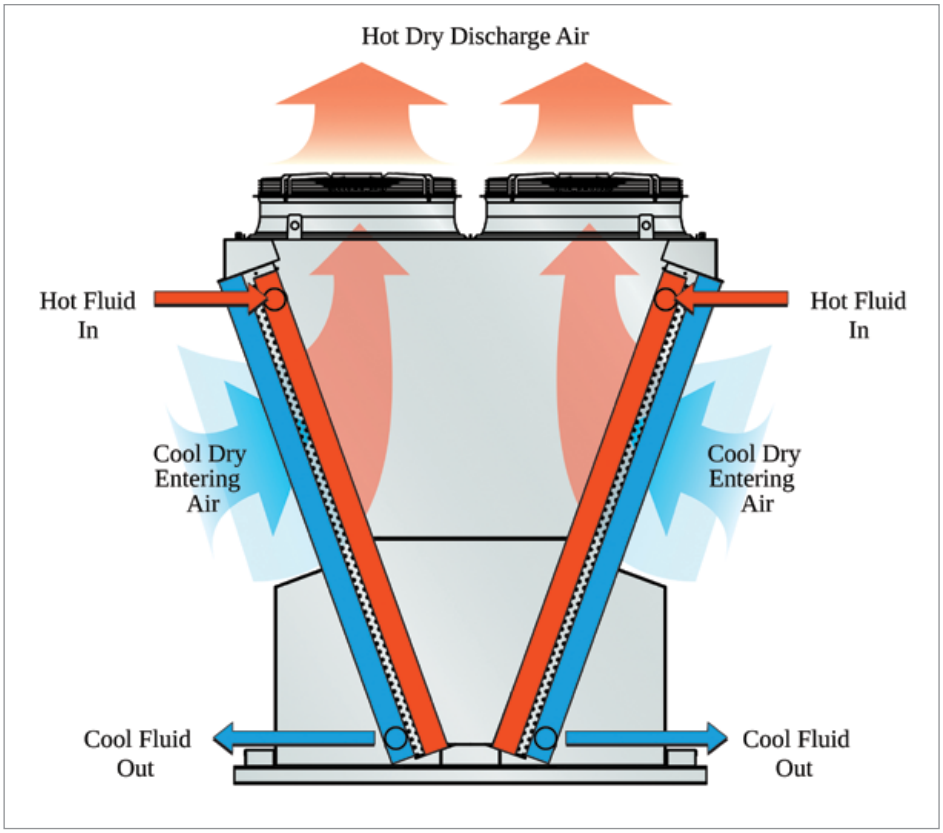
"In addition to 49-point tables, participating OEMs also share access to their own selection software with the Thermal Certification Administrator," said Nick Mascarenhas, Vice Chair, STD-201 and Chief Engineer – Thermal Modeling with Baltimore Aircoil Company. By granting the Administrator access to the manufacturer's selection software, the Administrator can verify the capabilities of the manufacturer to accurately predict cooling capacities of their units. Lastly, participating OEMs are required to share the Data of Record only with the Thermal Certification Administrator. This document covers full unit dimensions, air inlet surfaces, fan diameters, thermal performance, and all other component details. The Data of Record will also cover private labeling. Both the manufacturer and the private label brand are issued the same CTI Certification Validation Number for the same model unit.

## New and Evolving Test Codes and Standards

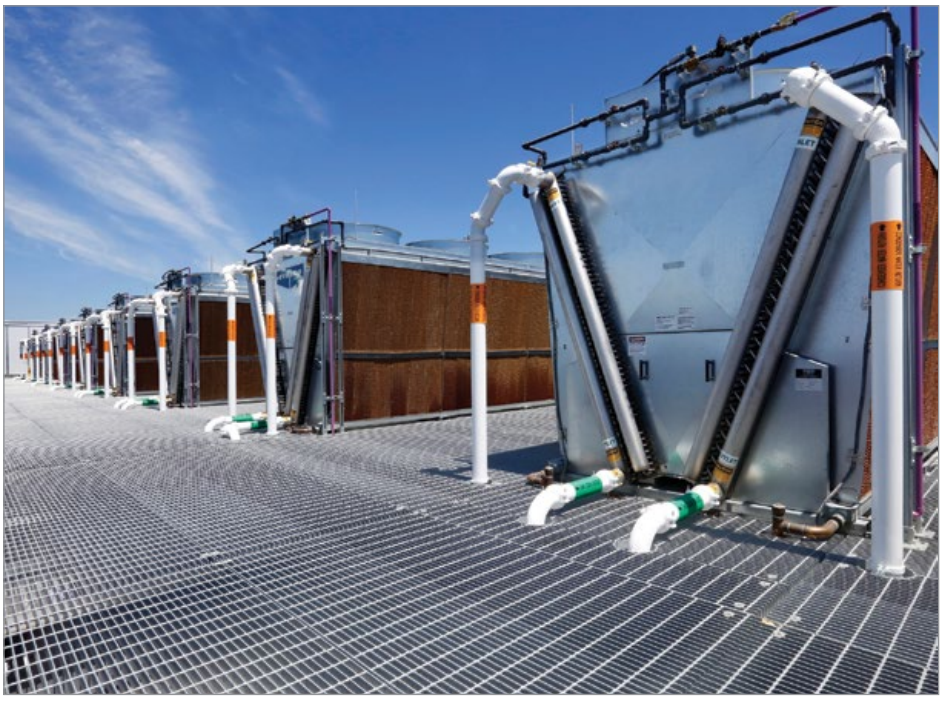
In 2018, CTI adopted the test code ATC-105DS for dry coolers. As of March of 2022, STD-201 now includes dry cooler thermal performance in the certification standard, which previously only covered evaporative products.

"Before 2018, there were no guidelines or regulations for testing dry coolers. Four years later, the prevalent certification standard STD-201 is now covering dry coolers – a big deal for the industry. Performance isn't in question anymore. Dry coolers are now being considered for projects more and more as the world continues to change," said Mihir Kalyani, Global Product Manager – Dry & Adiabatic Fluid Coolers, EVAPCO.

# CTI Standard 201: Certifying Thermal Performance of Heat Rejection Equipment




*Dry cooler principle of operation. Image courtesy of EVAPCO.*



*Multi-unit EVAPCO eco-Air dry cooler installation. Image courtesy of EVAPCO.*

Jennifer Hamilton was the committee chair for development of this test code. "It took a few years to create this certification program. We had to revise STD-201 to include dry cooling, appoint a certification administrator, write a new license agreement, update the licensed test agency agreements, have a certification test agreement as well as a non-certification test agreement, advertise for participants, agree on a date of record and a lot of other work! We are really passionate about this program," said Hamilton.

"Before, the only option for testing thermal performance of large installations of dry coolers was using a CTI test code in the field. At times, that is not feasible. Now, a customer can purchase multiple units knowing they're coming straight from the factory, tested and CTI-certified, with no need for field testing," said Natasha Rinehart, EVAPCO.

This year, CTI also launched its Product & Material Certification Program for open and closed-circuit cooling towers. The initial program will certify that fiber-reinforced pultruded (FRP) structural materials for use in cooling towers meet the material properties in Standard 137. STD-137 covers classification, materials, tolerances, defects, workmanship, inspection and the physical, mechanical and design properties of glass FRP structural shapes for use in construction items in cooling tower applications.

"This benefits the end user because they can feel confident while collecting bids knowing the equipment has been tested and certified," said Frank Michell, Product & Material Certification Administrator.

Larry Burdick and Nick Mascarenhas also both shared an acceptance test code for adiabatic coolers is also being developed. Other test codes and standards CTI has or is developing include flow, drift emissions, plume abatement, sound and more.

## Conclusion

Thermal certification of evaporative heat rejection equipment and dry coolers is helping end users and specifying engineers reduce the water and carbon footprint of their facilities, is preventing false performance claims and is helping improve uptime and reliability.

"Our organization is fully committed to CTI. We typically have representation on all task groups and committees. However, what's most important is the collaborative effort with other manufacturers, suppliers and end users developing standards for the benefit of the industry and the end user," said Scott Nevins, Vice Chair of the CTI Performance and Technology Committee and Director of HVAC, Cooling Tower Group with EVAPCO. BP

*For more information about the Cooling Technology Institute, visit www.cti.org.*

*To contact Associate Content Manager Bill Smith, email: bill@airbestpractices.com*

**Citation**

1. Answers to Frequently Asked Questions for CTI STD-201 Thermal Certification of Evaporative and Air-Cooled Heat Rejection Equipment | https://assets.speakcdn.com/assets/2793/answersforfrequentlyaskedquestions.pdf
2. Cooling Technology Institute Website | www.cti.org

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# Festo Smart Pneumatics and AI Solutions Spur Gains Toward Sustainability

By Mike Grennier, Compressed Air Best Practices® Magazine

*Increasing pneumatic intelligence helps manufacturers reach their sustainability goals.*

If there was ever a place where manufacturers can save energy using compressed air and make measurable gains toward sustainability, it's with pneumatics that power a seemingly infinite variety of machines and processes.

And industry leaders like Festo Corporation are helping them get there thanks to continued developments in pneumatic solutions. Advancements give manufacturers the ability to overcome long-standing barriers to compressed air efficiencies, one of which is the lack of easy-to-use in-house tools to optimize pneumatics. Another includes systems that automatically monitor airflow and ensure machines are operating with the optimum pressure versus over-pressure situations that wastes energy.

It all has to with continued breakthroughs in digital pneumatics and the evolution of Artificial Intelligence (AI) that work together or individually to achieve compressed air efficiency and lower energy consumption – and better position manufacturers to improve on their sustainability efforts.

"Smart pneumatics have been used for many years, but increasing intelligence is being built into the devices," said Frank Latino, Global Product Manager with Festo Corporation, based in Esslingen, Germany. Festo USA (www.festo.com) recently celebrated its 50th anniversary of operation in the United States. "Artificial Intelligence is also starting to emerge and we're seeing a lot of interest in it from end users."

## Pneumatics Getting Smarter

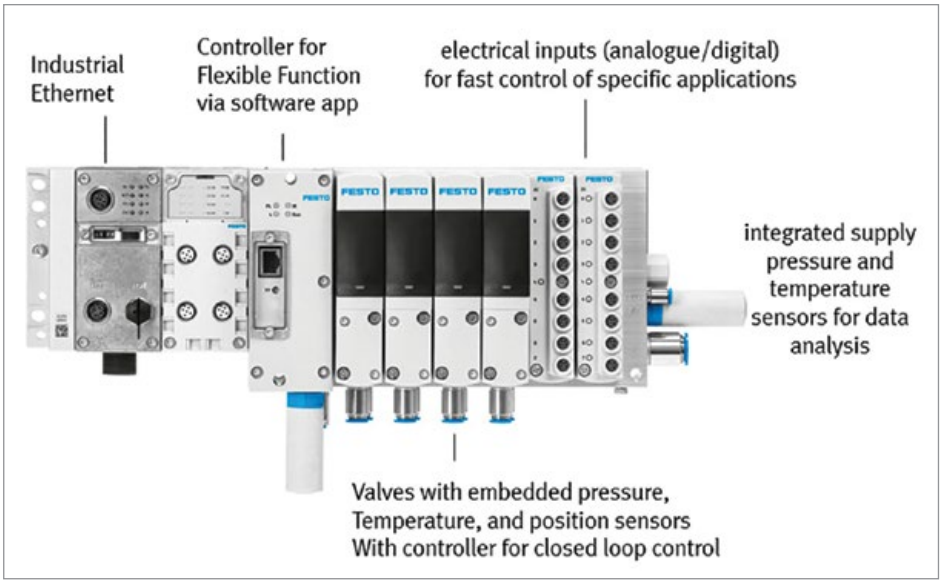
Increased intelligence essentially means smart pneumatics are becoming smarter, said Frank Langro, Director – Festo Product Market Management, Pneumatic Automation, North America. Today's smart pneumatics, he said, are radically different than conventional pneumatics.

"When I look at traditional pneumatics, I don't really consider anything very smart about them," Langro said. "You have a cylinder that extends and retracts with air supplied to the appropriate cylinder port," he said, adding, "a pressure regulator really just does what you tell it to you do. And a valve shifts from one position to the other based on the signal it gets."

What makes pneumatics truly smart, said Langro, is the ability of the device to gather information and subsequently act on it. He cites Festo's line of energy efficiency modules as an example. Each module combines a pressure regulator, on/off valve, sensors, and fieldbus communication for relaying information to higher level control equipment or data collection systems.

Unlike a traditional pneumatic solution, the module can monitor and control the supply of compressed air based on machine-specific parameters versus waiting for an operator to gather and analyze data after the fact to identify areas for efficiencies and then implement appropriate steps.

"It detects the machine's state whether it's in operational mode or idle mode. If it's idle, the device will do something such as reduce pressure, or maybe it shuts pressure off," Langro said as examples of how the modules can improve compressed air efficiencies.




*The Festo Motion Terminal VTEM incorporates multiple components, including an on-board processor for controlling pneumatic software apps.*

## Apps Deliver Control

Software applications are another way in which pneumatics have gone from being "smart" technologies to "intelligent" devices that control compressed air parameters.

Langro references an advanced valve terminal that essentially serves as a computer with sensors to offer functionality tailored to each machine. The device, called the Festo Motion Terminal VTEM and built into production machines, integrates valve electronics with pressure and temperature sensors. The terminal's on-board processor controls the software app functions.

One such app is known as ECO Drive, which among other capabilities, operates actuators with the minimum amount of air pressure to move the load.

"Normally, when a cylinder extends you still continue to pressurize that volume until you get up to line pressure. But many times, you don't need to continue to pressurize that system," Langro said. "The module detects that the motion has been made and basically shuts

# Festo Smart Pneumatics and AI Solutions Spur Gains Toward Sustainability

the valve off and stops the pressurization of that volume so you're consuming less air."

Another compressed air-saving app controlled by the Motion Terminal detects volume leakage due to any number of issues, including aged tubing or sudden leaks. If a leak is detected, it notifies operators, so they take appropriate action.

"The app learns the pressure profile based on several cycles it has run through," Langro said. "Once the parameters are learned, it monitors the profile and detects if there is an improper profile, indicating leakage."

Langro said apps like ECO Drive can deliver exponential energy savings given the numerous cylinders and valves powering typical machines and improve overall machine reliability since problems with performance can be spotted early.

"It's tough to quantify the exact energy savings because it depends on the pressure and volume of air in your system, as well as things like tubing length," said Langro. "But we've seen up to 70% compressed air reduction with the ECO Drive app on one cylinder. If you multiply that over and over with multiple cylinders on one machine and multiple machines, the savings can be quite substantial."

## AI Offers Actionable Insights

While smarter pneumatic devices can go a long way toward helping achieve compressed air efficiencies, so too can AI, which has evolved to let users more readily gather critical data and make immediate corrections or map out strategies for ongoing energy-saving measures.

Latino points to the Festo Automation Experience AI platform as an example. The software uses algorithms and machine learning to determine in real time whether a smart, or traditional pneumatic device, is in a "healthy state" based on specific parameters. If not, it notifies the user and provides a recommended course of action. Through algorithms and user inputs, the software learns over time whether an anomaly is acceptable based on conditions deemed "healthy" or whether it's something like an air leak that needs attention.

*Artificial Intelligence solutions help users better manage compressed air powering pneumatics.*

"Whether it's standard data from cylinder switches and coils that trigger a basic on and off action, or more sophisticated data like pressure and flow from a smart pneumatic device, AI collects that data so users can make good use of it," Latino said. "If you start to see airflow increasing, leakage could be a factor. The users can then address it before it gets too bad."

A major advantage of AI is the ability it provides to better manage compressed air leaks when compared with traditional leak audits, said both Latino and Langro. The capability is worth noting since 50 to 70 percent of compressed air leaks occur on pneumatic circuits of production equipment.

*Access to actionable data for pneumatics and compressed air use continues the trend toward easier to use systems.*

"With sensors correctly deployed in the system to catch this, it's far superior to doing a leak audit once a year or something like that," said Latino, noting how AI takes leak auditing to a new level.

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Presenter Mike Womack, Thermal Certification Administrator, Cooling Technology Institute – *Sponsored by EVAPCO*

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# Festo Smart Pneumatics and AI Solutions Spur Gains Toward Sustainability

"I agree," said Langro. "Even after audits are done many people don't implement what's been recommended because the machine is still running, or whatever. But when you have a system that provides notifications based on live data, it's natural to go fix it as opposed to saying, 'Okay, we've got our audit report. Let's look at it next week.'"

AI platforms are also making data more readily accessible, said Latino, since Festo's platform can connect with the plant's own network servers, or the cloud, with access to user-friendly dashboards. The technology supports the desire of manufacturers to develop proactive strategies for compressed air efficiencies.

"Everyone is moving toward the ability to simplify this collection of data and make things easier for users. AI is emerging and it will only improve over time," Latino said.

## End Users Drive Change

Whether it's widespread use of smart pneumatics or the adoption of pneumatic AI solutions, Latino and Langro note the increased desire on the part of end users for machines designed with pneumatics that can help them better manage compressed air and save energy.

"End users are saying they want to operate on lower pressure levels. That is definitely happening," said Latino, as an example of needs expressed by manufacturers. "If their machine is designed to work sufficiently on lower levels, our products will work at those levels."

Latino said OEMs and end users are also showing growing interest in AI as a way to achieve energy-savings and productivity goals.

"We're seeing more of that from end users right now, but it's growing on the OEM side as well," Latino said. "End users are saying they want to deploy some kind of predictive analysis, whether it's to achieve energy or maintenance goals."

Festo guides OEMs and end users on pneumatics best practices, but Langro thinks manufacturers should specify to OEMs what they want from pneumatics when it comes to compressed air, such the ability to operate at lower pressure versus the traditional level of 90 psi.

"They've got to demand that from the OEM because the OEM is going to take the easier, standardized design path if it's left up to them," Langro said. BP

*All photos courtesy of Festo Corporation.*

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# Tank Applications in Central Cooling Systems Part 1 – To Be or Not to Be

By Clayton Penhallegon, Jr., P.E., Integrated Services Group

*Typical Chilled Water Tank System*

In some companies and industries, open tanks are common features of process cooling systems.[1] In others, tanks are never or rarely seen. Why the difference? Who's right? Should we all be using tanks or not?

This article will explore why tanks are used in cooling systems, why they might not be used in cooling systems, and finally considerations to be evaluated in determining if tanks are needed in any particular central plant cooling system. Part 2 will review specific application details for using tanks and also for tankless systems and system conversions.

## Why Tanks are Used

The first question to answer is why are tanks used in systems? Technically they are not part of a simple flow circuit that consists of a pump, cooling resource(s), cooling load(s), and connecting piping. Even so, tanks can perform several useful functions in cooling systems such as:

- Providing additional system volume for small systems to prevent chiller short cycling[2]
- Chiller flow stabilization in systems where the flow to cooling loads varies dramatically, such that the chiller(s) may repeatedly fault on loss of flow if not decoupled from the process cooling flow
- Chiller load smoothing for irregular or highly transient cooling loads
- Flow equalization in split cooling recirculation / process flow systems with separate loops to each part
- Physical and / or non-hydronic functions such as drain-down volume accommodation, system water loss makeup, or cooling water supply stabilization for highly sensitive applications or in unreliable cooling supply situations


*Typical Tower Water Tank System*

There are several companies that produce high quality, well-designed tank systems that often also include pumps and their associated hydronic components. The tank systems are typically offered in addition to other cooling system components like chillers, cooling towers, etc. which together can comprise a cooling solution that is complete except for the piping to the cooling loads. These companies promote the use of tank systems and the advantages they can offer, as would be expected.

These functional advantages are often most applicable in specific manufacturing situations. The typical applications include:

- Packaged, dedicated systems with a tank built into the package typically serving only a single load or line such that the load is essentially on or off but the chiller is able to run continuously, albeit cycling on and off as necessary
- Smaller site-assembled systems with small numbers of loads (typically fewer than 4 – 6 independent lines or points of use) that operate inconsistently making it a regular occurrence that no active loads are on while the cooling system is running
- Cooling tower gravity drain down for freeze protection and other pipe gravity flows from non-operating systems

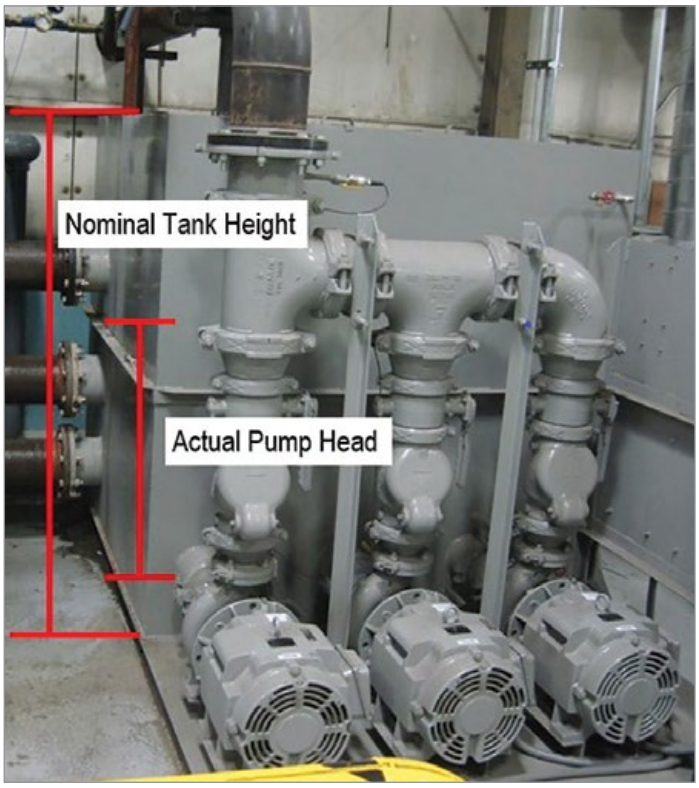
*Crowded equipment after plant growth*

# Tank Applications in Central Cooling Systems Part 1 – To Be or Not to Be

- Significant batch heat loads or other highly variable heat loads such as long cycle mold cooling for large parts[3]

- Narrow process delta-T applications where the process requires a minimal temperature difference (such as injection molding mold cooling) where the chillers can't effectively operate with that same temperature difference

*Pump added on top of chilled water tank*




*Effective pump suction much less than tank height*

- Plants where perceived simplicity of operation and upset tolerance are paramount over potential energy savings and maintenance benefits

- Given these benefits, why wouldn't tanks be used in every system? This view is validated by many installations where we see tanks used in central plant systems ranging from 40 tons up to 1500 tons in size. In many of these applications, the tanks[4] could be viewed as not critical but functional. They provide simple and convenient operation for the plant staff with minimal perceived drawbacks. End of story, right? Well, not so fast.

## Why Tanks Would Not be Used

Like many things, tanks have pros and cons. The skeptic asks why should we not use tanks? There are several good reasons for looking critically at tank applications.

First, tanks are not technically required except for the specific situations listed above. As noted before, they are not critical components of the cooling system circulating loop in the same way as, for example, the pump, check valves, etc. Once installed in systems, however, they become nexus points to which many, if not all, of the flow circuits in the system are connected. In significantly expanded systems, this becomes a very real chokepoint for space to connect pumps and return pipes to the tank.

Second, tanks cost real money to purchase and install, as well as to maintain, and also incur opportunity costs for the plant floor space dedicated to the tank. Tanks are most frequently purchased as tank and pump systems outfitted with multiple pumps and pump groups (anywhere from two to six are common and some hot well / cold well systems have ten or more pumps installed), and these pumps, their electric supply components, and their associated piping components (e.g., check and isolation valves, strainers, etc.) all cost yet more money to purchase, install, and maintain.

Third, tanks impose significant hydraulic penalties on the systems where they're installed, even though those penalties are generally not recognized. This occurs through at least three mechanisms:

1. Low pump suction head (frequently with entrained air bubbles – see below) usually only in the tens of inches even with tanks that

are 5 – 6 feet tall due to the requirement for the tanks to have space to absorb system drain down volume without overflowing.

2. Loop return water mixing which blends down return temperatures from the floor and blends up the chiller supply temperature to the process, typically by at least 1°F the wrong way on each loop.[5] These conditions in effect mean that the supply temperature control to the plant is random based on the conditions in the tank and not on the chiller settings.

3. Pressure head waste of the returning water by releasing it back to atmospheric pressure and diffusing the flow energy in swirling the water in the tank. This is a straight loss that is ultimately converted into very slightly warmer water for the chiller to cool.

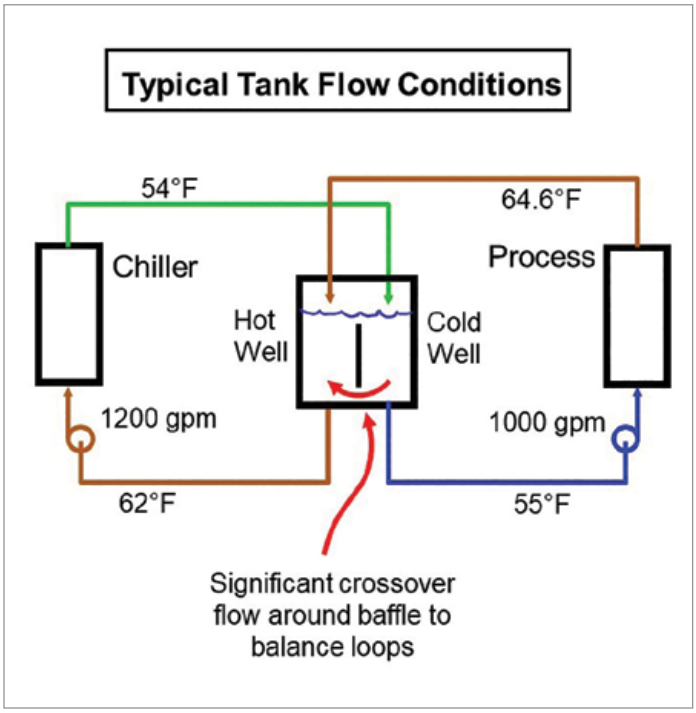
In combination, these reduce the net delivered pumping efficiency and make the heat rejection less efficient, whether through a chiller or a cooling tower. Note we're not talking about 50% efficiency penalties here, but if you're designing for high efficiency, every little bit helps.

Fourth, tanks always introduce air into the water systems and frequently allow dirt and debris to enter as well. Both of these can increase corrosion in the system and cause problems with air collecting in heat transfer and other components. This condition is even worse in the highly common condition of tanks that were originally properly sized for a system but which have become dramatically undersized with plant growth.

We have seen dozens, if not hundreds, of tanks that now serve essentially as blenders with greater GPM flows than the tank volume itself, and this is worse in larger systems as few companies are willing to spend the money to have a tank proportionally as large in a 500 ton or larger system as they will for a 50 – 100 ton system. Air in cooling systems contributes to dramatically higher rates of corrosion in open systems than in closed loop systems that can be substantially stripped of dissolved air.[6]

In addition, while tanks have reasonably closely-fitting covers when installed, over time these get loose, lost, cut away for pipe entries, etc. such that dirt and debris can enter. Plastic resin pellets are particularly fond of getting into water systems where they are sized perfectly to clog strainer elements with 1/8" holes! Tackling these problems requires close attention to tank top entry points and system filters / strainers, as well as aggressive (and more costly) chemical water treatment.

Finally, all the perceived benefits of tanks in central plant systems beyond a critical cut-off size can be realized through effective system design and control. This cut-off size may vary between around 100 – 200 tons but is more about the system flow requirements and the number of lines and their cooling flow and temperature characteristics than about the absolute size. There must be a continuous water flow path for the chiller(s) to operate but if the nature of the heat loads is such




*Mixing and imbalanced flows impact temperatures*

*Rare tank with minimal aeration, still note rust on pipe*

# Tank Applications in Central Cooling Systems Part 1 – To Be or Not to Be

that there will always be open flows if the plant is in operation, such as uncontrolled cool-side heat exchangers, air handlers, etc., then the likelihood is very low of having deadhead flow conditions while the cooling plant is in operation[7]. The larger the plant and the more lines there are, the more the cooling flows and loads become statistically continuous and the less likely the conditions necessitating the use of tanks exist.

*Typical highly aerated tower tank return*

*Highly aerated, free falling tower process return tank*

*CHW hot well with aeration and balancing flow from cold well*

Proper piping design and system control coupled with the inherent flow conditions in larger plants make tanks unnecessary. Closed piping systems can be designed in either primary – secondary configurations or as single variable-flow loop systems, and both of these designs eliminate the hydraulic weaknesses of tank systems and the potential for significant air entry in the system.[8] By being closed systems, the issues of low suction head and loss of return pressure head are eliminated, as is the need for piping volume drain down storage; and the flow balancing to cooling equipment and process loads should be straightforward through the system controls.

## How to Decide if Tanks are Worth the Costs

When considering the need for tanks in a central plant process cooling system, answering the following questions will help determine if they should be installed. Note the questions are carefully structured to make assessing the answers easy, in particular so that Yes answers point to the potential use of tanks in the plant.

**Is the system a central plant design that *does not* and *will not* ever grow to serve six or more lines?**

We all know the propensity of manufacturing plants to change and grow but sometimes there are strict limitations ensuring they won't – dedicated contract facilities, unchangeable production space limitations, etc. If there are no hard limits like this, it's better to assume they will grow and answer this "No" assuming typical blow or injection molding, extrusion lines, or other heat loads of 20 – 25 tons or so.

**Are the cooling loads substantially characterized by discontinuous flows (e.g. solenoid valve operations, frequent machine starts & stops, etc.) such that only a small portion (≤ 25 – 30%) of the total flow, if any, is continuous and normally open for flow?**

Many production cooling applications have mostly open flow devices as a significant portion of their heat loads, such as open flow mold cooling, extruder feed throats, hydraulic cooling heat exchangers, etc. that take continuous water flow when running, with temperature variations

reflecting the actual heat load (higher delta T at greater loads and vice versa). If a plant's overall process mix has mostly continuous cooling flows and virtually no instances of zero or near zero flows (except when lines are valved off due to maintenance, mold changes, etc.), then this should be answered "No".

**Are the cooling loads sufficiently variable or definitively non-uniform that they *can not* be reasonably expected to present a more or less steady load, both in flow and temperature difference, to the central plant cooling?**

Cooling loads can vary in both flow and temperature change, and extreme variation in either or both components can be challenging for a cooling system. Many modern chillers with electronic controls can operate reliably with flow variations of 30 – 50% per minute, and some can be equipped with anticipatory controls that directly monitor flow and / or entering temperature to improve that stability over even greater changes in load characteristics. Even so, load changes beyond that exceed virtually all chillers' ability to maintain control over the leaving water temperature and, in sufficiently challenging cases, their ability to continue operating.

Any of the following conditions could cause loss of temperature control in a system – loss of control here being defined as more than "a couple of degrees for a couple of minutes" such that undesirable process cooling load effects can be expected:

- Functionally instantaneous changes in flow or temperature difference (or the blended combination) of more than 2:1[9]
- Changes in temperature difference that exceed the design capability of the chiller (e.g., a 7°F delta T becoming a 15 or 20°F delta T without offsetting flow changes [and sometimes even with flow reductions it's not enough])
- Intermittent absolute cooling loads in excess of the chillers' capability (e.g., a 50 ton load for 10 minutes on a 20 ton chiller).

If none of these are true or likely on an overall system basis (e.g., the combined total system effect even if there are specific loads with these characteristics) at the chillers, then this can safely be answered "No".

# Tank Applications in Central Cooling Systems Part 1 – To Be or Not to Be

**Are there any requirements for either significant volume acceptance or volume loss management[10] that can't be adequately met through non-tank methods?**

If a system has normal operating requirements for meaningfully varying liquid volumes then tanks provide an excellent means of managing the volume changes effortlessly. While the amount that would be "meaningful" varies by system size, typical volumes might be 30 – 50 gallons or more in or out of a system. Examples would include cooling towers draining down several hundred gallons (i.e., volume into the system)[11]; cylindrical or other welded tanks filled, cooled, and flushed with water that is filtered and returned to the cooling system later (volume out and then volume in); or water to fill large molds and connecting piping and hoses after a mold change (volume out). If these circumstances do not apply to a system, then this would be answered "No".

*Steel pipe corrosion in highly aerated stainless steel tank*

*Chiller CHW inlet corrosion and deposits on tank system*

**Does the host site lack the technical competence and / or the corporate technical support to operate a closed-design central system?**

One of the great benefits of tanks in systems is their perceived simplicity of operation, and it is absolutely true that they streamline certain elements of running cooling systems. Almost anyone can understand that the water in the tank must be kept at a certain minimum depth, and simple visual indicators can help monitor the level status. If a plant has only generalist maintenance and technical staff, or even purely operators (e.g., a very small plant with no defined support staff), then tanks are helpful to enable the operation of the cooling system.

As noted earlier, there are other cost and operating implications from tank use and these must be balanced against the simplicity argument. If a plant has peers that do not use tanks (showing the processes can operate without them) and if they have good local or corporate technical staff knowledgeable or capable of learning about closed system operations, then it is a candidate for tankless operation and can safely answer "No" to this question.

If a plant can answer "No" to all of these questions, then tanks do not offer compelling reasons for their use that would offset the negative aspects. However, if a plant answers Yes to one or more then use of tanks would likely provide operating benefits to the plant that would more than offset the cost implications.

## Conclusion

Tanks are very common in many small to mid-sized process cooling systems. In many cases, the decision to include tanks is made uncritically due to experience in other plants, custom within a company, or well-intentioned recommendations by sales representatives who are very familiar with the benefits but less so with the drawbacks.

This article has set forth the pros and cons of using tanks from the author's perspective and has offered considerations for evaluating the need for tanks in any given cooling system. The second part of this topic in a following issue of Cooling Best Practices will discuss specific details of using tanks, designing tankless systems, and converting systems with tanks to closed systems.

Given the nature of multiple conversations over the years with various parties regarding tanks in cooling systems, an interesting discussion of this article's perspectives is expected! BP

*For more information about Integrated Services Group visit https://www.isg-energy.com , email: info@isg-energy.com, tel: 770.823.8235*

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**Endnotes**

1. Open reservoir tanks at atmospheric pressure as distinguished from closed tanks for pressurized cooling flow or integral processing applications.
2. Heat rejection is performed by chillers, cooling towers, and special purpose heat exchangers (such as free cooling systems or other dedicated function HXs) and most of the concepts discussed in this article are applicable to all of them. As chillers are typically the most difficult to manage, this article will most often refer to chillers as the cooling resource for implications of tank uses and other system operation considerations.
3. ISG had a client that produced chemically-foamed synthetic rubber material that was heat-activated in steam jackets and then cooled to stop the reaction with cooling water sent through the same mold channels used by the steam. The instantaneous heat load at the peak was 400 tons while the cycle average was 25. No chiller could operate through the cooling requirements, and it wouldn't be cost effective even if it could.
4. Tanks plural, since the vast majority of the systems use a hot well / cold well design with two tanks or a single, baffled tank providing two temperature regimes.
5. The baffles and level-maintenance features of tanks necessarily mean that the water in the tank, particularly single container hot & cold well designs, is constantly mixing between the two loops even if the flow rates are precisely matched, which of course virtually never happens.
6. Cooling tower loops cannot of course be closed loop systems, but they can be made very concise by designing them as short pipe runs to chiller condensers and separately to closed machine cooling loops behind plate heat exchangers.
7. If required, pressure controlled valves can be installed in systems to enable return flows to bypass closed off cooling loads when machines are down.
8. Closed hydronic systems should be equipped with air separation devices that, combined with proper water treatment, dramatically reduce the corrosion rates in closed systems vs. open, highly aerated systems.
9. "Instantaneous" for a cooling system is a flow change of more than ≈30% flow in one minute, a change in temperature of ≈4°F in two minutes, or a combination of both in lesser degrees.
10. Volume loss management is the maintenance of acceptable system performance even if it loses a meaningful amount of water (amount TBD dependent on specific system criteria), but typically defined to mean more than can be replaced by the make-up water system in 1 – 2 minutes. For example, if a system capable of making up 12 GPM loses 50 gallons in a 2 minute hose break, or requires 25 gallons to fill a newly installed mold and associated piping, can the expansion tank maintain acceptable suction pressure level at the circulating pumps for the system to continue operating smoothly?
11. Note that water draining back to a tank from system piping does not count as drain down volume that has to be accommodated. This condition is a function of having a tank and siphon-breaking aeration in the system, and would be eliminated in a closed system.

# On-Premises Nitrogen Generation Addresses Carbon Dioxide Supply Concerns for Breweries

By Garrett Rinker, Senior Project Engineer, South-Tek Systems


*A Pressure Swing Adsorption (PSA) On-Premises Nitrogen Generation System*

## Carbon Dioxide Supply Chain Issues

Supply chain issues in recent years have forced many companies to reconsider their entire business approach. Greater priority has been placed on maintaining a steady inflow of required resources. A recent shortage of carbon dioxide supplies has been putting additional strain on businesses nationwide, particularly those in the brewing industry. This shortage can be attributed to a combination of several factors, including the continuation of general supply chain issues, high demand for carbon dioxide over the summer months, and elevated hydrocarbon levels in the product carbon dioxide from the Jackson Dome (one of the nation's largest gas production sites) observed around September 2022.

One strategy to remove some uncertainty in a supply chain is to reduce the number of third-party vendors involved in the business. For example, it may be worthwhile for companies purchasing goods from a vendor to produce said goods on-premises, if possible. This article aims to provide a potential solution for breweries facing delayed deliveries and price increases associated with carbon dioxide: Utilize on-premises nitrogen generation to serve as a partial or full replacement for purchasing liquid carbon dioxide for some processes.

## Carbon Dioxide and Nitrogen Usage in Breweries

Carbon dioxide and nitrogen have various usages in breweries. They are utilized as process gases (primarily for the movement of fluids while maintaining an inert environment) and for giving beverages distinct taste and visual characteristics.

Carbonation gives beer its fizzy appearance and prevents spoilage. Most beer produced in breweries is carbonated by directing a flow of carbon dioxide through the beverage. This lowers the required process time for carbonation from weeks (via natural carbonation) to days. Beer produced at the commercial level in America is typically highly carbonated and light.

During fermentation of the brewing process, carbon dioxide is released as a byproduct when yeast digests sugars. Technology exists to capture and reuse a portion of the released carbon dioxide during brewing, which reduces the volume of gas needed to be purchased. However, cost and production limitations have prevented many smaller breweries from purchasing these technologies, as said technologies are generally more practical in large scale applications.

## Opportunities to Replace Carbon Dioxide with Nitrogen

Carbon dioxide and nitrogen serve similar purposes in brewery processes. Replacing carbon dioxide with nitrogen is a viable solution for processes such as blanketing, purging, moving liquids, etc., where a specific gas may not necessarily be required. Both carbon dioxide and nitrogen are considered to be inert gases, as they do not readily react with other substances. Nitrogen can be utilized as a process gas without altering the carbonation characteristics of the beverage, and is usually added to kegs for pressurization.

Billy Chestnutt, an Industrial Sales Manager at South-Tek Systems, says, "South-Tek Systems entered the brewery market 19 years ago with our BeerBlast Nitrogen Generators that provide beer gas to push beer to the tap. Within the last couple of years, brewers have investigated switching some $CO_2$ processes to nitrogen due to the nationwide $CO_2$ shortage. The applications for nitrogen that we see in the brewing process include purging/blanketing of tanks, pushing product from tank to tank, pre-purge on canning lines, running the keg washer, nitrogenating beer, and testing in the quality assurance lab."

Many breweries have recently started producing "nitrogenized beers", which only involves nitrogen during brewing rather than a blend of carbon dioxide and nitrogen. For comparison, brewing ales and lagers typically involves a 70% carbon dioxide and 30% nitrogen blend, whereas stouts and porters tend to utilize a 25% carbon dioxide and 75% nitrogen blend. Nitrogenized beers tend to have a smooth taste and a lasting foam head. Beer is usually nitrogenized by forcing nitrogen into the beverage at high pressures, since nitrogen does not naturally combine with it the way carbon dioxide does.

## Nitrogen Generation Processes

The three main processes by which nitrogen is separated from oxygen and other substances in air are cryogenic distillation, membrane systems, and pressure swing adsorption (PSA). Cryogenic distillation was the first of these processes to be developed, dating back to 1895 when it was introduced by Carl von Linde. It is the process by which liquid nitrogen is obtained. Membrane and PSA technologies were not widely used for nitrogen separation until the 1980s. Each of these processes have a range of product nitrogen flow rates and purities in which they are better suited to operate than the others. Membrane or PSA systems are recommended for on-premises nitrogen generation for brewery applications.

## Cryogenic Distillation

Cryogenic distillation involves cooling an input flow of air below the boiling points of its constituents. The difference in boiling points of these constituents allows for their separation. The required temperature to liquify the components of air during this process is extreme; at atmospheric pressure, the boiling points of nitrogen and oxygen are approximately -320°F and -297°F, respectively.

Cryogenic distillation provides the greatest purity nitrogen of the three nitrogen generation processes (>99.9995%). However, it is more energy-intensive and costly than membrane or PSA systems, making it economically viable only for large-scale systems.

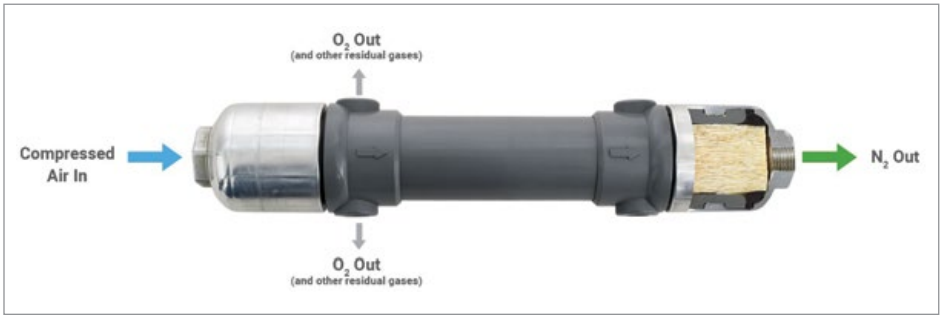


*Figure 1: Membrane Filtration Device for Nitrogen Separation*

# On-Premises Nitrogen Generation Addresses Carbon Dioxide Supply Concerns for Breweries

## Membrane Separation

Membrane systems operate via selective permeation, where differences in gas molecule diffusion rates through a packed container of hollow fibers drives separation. The hollow fibers selectively permeate oxygen, water vapor, and other impurities from an input flow of compressed air, leaving nitrogen as a product.

Membrane systems can typically provide nitrogen at a purity of 99.5% and are recommended for applications where a flow rate of less than 1,000 SCFH is required, though greater flow rates can be achieved depending on membrane sizes. Figure 1 shows an example of a membrane filtration device designed for nitrogen separation from a compressed air input.


*Figure 2: PSA Nitrogen Generation Systems*

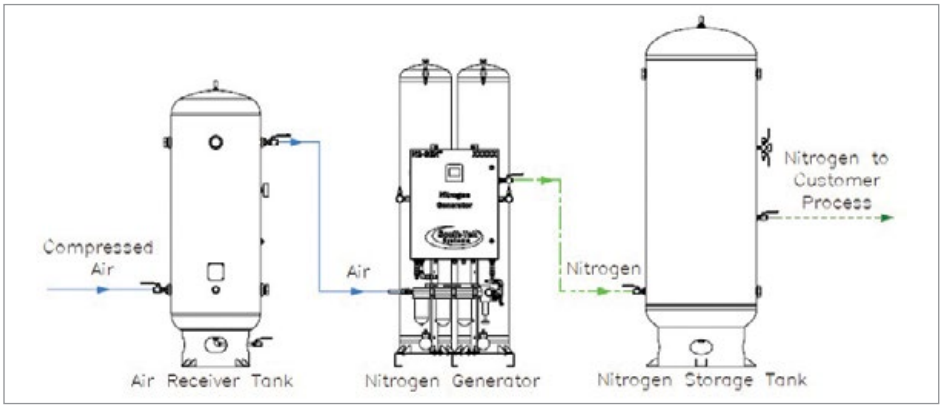


*Figure 3: General Arrangement of a Nitrogen Generation System*

## Pressure Swing Adsorption

The typical PSA process involves two pressure vessels (referred to as "sieve beds") filled with carbon molecular sieve (CMS), a material that selectively adsorbs gas molecules at pores on its surface. These pore sizes are on the scale of Angstroms, a unit of measurement equal to 0.1 nanometers. When pressurized, gas molecules begin to fill the pores. Oxygen and nitrogen have molecular sizes of 2.99 and 3.05 Angstroms, respectively. Due to the fact that molecules of oxygen are smaller than those of nitrogen, more oxygen molecules are adsorbed at the pores of the CMS.

During the PSA process, only one of the sieve beds is actively separating nitrogen from an input of compressed air. While one sieve bed is active, the other is exhausting gases stored in the CMS from the previous cycle. The rate of adsorption in the CMS of the active sieve bed will decrease with time, as the CMS can only hold a finite amount of gas molecules. Eventually, the output nitrogen purity from the active sieve bed will start to drop (a point referred to as "breakthrough"). The input flow of air is then switched to the other sieve bed, and the cycle repeats itself. Some examples of PSA nitrogen generation systems are shown in Figure 2.

PSA systems can supply a wide range of nitrogen purities and flow rates; nitrogen purities can range from 95% to 99.999%, and typical flow rates can range anywhere from 50 to 35,000 SCFH. Factors affecting nitrogen purity and flow rate include input air flow rate, mass of CMS utilized, cycle timing, adsorption pressure, etc.

Figure 3 is a basic schematic of how a nitrogen generation system is generally arranged.

Two tanks (one for input air and one for product nitrogen) are recommended for most applications to stabilize system pressures when the PSA cycle switches the input air flow between sieve beds.

## Benefits of On-Premises Nitrogen Generation

PSA systems designed for the separation of carbon dioxide from other gases exist, though these systems are best applied when a large input flow of flue gas is available, making them unfit for a brewery setting. The average cost of liquid carbon dioxide (due to the impact of recent supply and demand) is about $3.50/kg, or approximately $18/CCF (representative of the gas phase at standard conditions).

Costs associated with nitrogen in liquid bulk tanks, liquid dewars, and high-pressure cylinders are approximately $1/CCF, $5.50/CCF, and $25/CCF, respectively. However, nitrogen generated on-premises can cost as little as $0.10/CCF, which is representative of the electrical power required to operate the system.

The initial cost of a nitrogen generation system may be greater than high-pressure cylinders and liquid nitrogen containers, but most companies will reach a return on investment within 12-18 months with proper sizing of the system based on process demands. Breweries typically experience savings associated with gases of 50-75% by switching to on-premises nitrogen generation. If a regular maintenance schedule is followed, PSA nitrogen generation systems can have a life expectancy of 15-20 years.

Approximately 79% of ambient air is nitrogen, so the system will never have a shortage of gas to process. An on-premises nitrogen generation system provides a reliable supply of process gas, one that does not continually depend on third-party vendors. BP

*About the Author*

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*About South-Tek Systems*

*Founded in 2003, South-Tek Systems is the industry's leading nitrogen generation manufacturer. Offering both standard product lines and engineered-to-order generation solutions, South-Tek delivers best-in-class nitrogen generators for worldwide distribution. South-Tek Systems is located in Wilmington, North Carolina. For more information, visit https://www.southteksystems.com*

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# Chiller & Cooling System Technology & Industry News

## Atlas Copco Launches TCA Water Chiller Range

Atlas Copco announces the launch of their new TCA water chiller range featuring four new versions. With its patented adiabatic pre-cooling system and a free-cooling section, the four-model TCA55-215 plug and play industrial water chiller range offers cooling capacities from 55 to 228 kW and a host of unique features designed for optimum energy efficiency and complete operational safety, as well as for easy and cost-effective installation and maintenance. Reliable and robust, the chillers feature proven scroll compressors in a twin circuit configuration, air-cooled microchannel condensers, and an integrated hydraulic module.

*Atlas Copco TCA water chiller range.*

The TCA55 to 215A process chiller range comes in four configurations, comprising TCA-A, TCA-AF, TCA-AD and TCA-AP variants. The A models provide industrial robust construction and operational reliability while both the AF and AP versions feature the option of free cooling (using colder ambient air to perform cooling). With the advanced adiabatic pre-cooling capability of both the AD and AP chiller units, it is possible to achieve the highest level of energy efficiency for process operations. That can mean a reduction of electricity consumption by up to 40% compared to non-free-cooling units, and cooling capacity boosted by up to 17%.

In addition, all four TCA variants include the option of a built-in hydraulic circuit with integrated buffer tank and single or double pumps, for primary/back up, which operate across cooling systems requiring resistance of 42 or 72 psi working pressures. The inclusion of a shell and tube evaporator makes it possible to effectively use these chillers reliably for a wide range of industrial process applications.

Thanks to the rugged and reliable construction with IP54 protected components, TCA55-215 series chillers can be installed primarily in outdoor locations. This optimizes cooling water distribution and provides the opportunity to benefit from cold winter air temperatures to gain efficiency for the chiller variants with AF/AD/AP configurations.

Drawing on years of experience and knowledge of air compressor controllers, the TCA55-215 range is equipped with an Elektronikon® Mk5 Touch controller and a regulation system designed to maximize the chiller's performance under a variety of climatic conditions. The Elektronikon® Touch controller also provides an opportunity to regulate inlet or outlet hydraulic circuit water temperature within a predefined band with a state-of-the-art level of precision.

Another feature which the TCA chillers have adopted from air compressor design is the Atlas Copco SMARTLINK cloud-based monitoring system, which brings unique, Industry 4.0 enabled features to the industrial cooling market. SMARTLINK enables online monitoring of the chiller unit's main working parameters, gives early warnings of any problems or upcoming maintenance needs, and makes recommendations for optimization and energy efficiency.

### *About Atlas Copco Compressors*

*Atlas Copco Compressors LLC is part of the Compressor Technique Business Area, headquartered in Rock Hill, South Carolina. Atlas Copco Compressors provides innovative solutions, including world-class compressors, air blowers, industrial coolers, vacuum pumps, quality air products, and gas generation systems, all backed with full service, remote monitoring, and auditing services. With a nationwide service and distribution network, Atlas Copco Compressors is your local, national, and global partner for all your compressed air needs. For more information, visit www.atlascopco.com/air-usa.*

## SPX Cooling Introduces Marley CoolBoost Opti FC Control Panel

SPX Cooling Tech, LLC, a full-line, full-service industry leader in the design and manufacture of evaporative cooling towers and air-cooled heat exchangers, has introduced the Marley CoolBoost Opti FC Control Panel, a new and intuitive control system designed for Marley MH and DT fluid cooler models. CoolBoost Opti FC gives users the ability to optimize their system's performance with flexible operating modes designed to conserve energy or water, depending on the selected mode.

"The modern features of the CoolBoost Opti FC interface – the touchscreen and the easy-to-use comprehensive status view – are almost enough to distract from its most-impressive feature: it allows operators to select dry-priority or wet-priority modes for saving water or energy, when necessary," said Aaron Todd, Product Development Lead with SPX Cooling Tech.

The control panel gives operators the option to choose one of four modes: Wet First, Dry First, Wet Only or Dry Only. Wet First and Dry First modes allow users to setup a staging effect for when the pump and fan are turned on and off based on system requirements and environmental factors. Wet Only and Dry Only modes let the fluid cooler operate without the use of the pump or the fan respectively.

Other features of the control panel include an integral PLC for selectable control options – including Auto, Hand and Off – and BMS integration capabilities that allow for remote or local system control. The CoolBoost Opti FC panel is also BACnet communication compatible, simplifying integration into BMS systems for monitoring, control and saving historical data.

"Another big plus for CoolBoost Opti FC users is its single-point power connection, which eliminates panel design time and could save significant installation hours, and the electrician costs associated with them," said Todd.

The control panel itself is constructed with a NEMA 3R painted enclosure – or can be made as optional NEMA 4X fiberglass or stainless-steel enclosure – that includes external disconnect handle with padlocking provision to meet lockout/tagout safety requirements. It is built to UL508 and cUL508 safety requirements. A protective cover is also provided to guard the HMI screen from the elements.


*The Marley® CoolBoost™ Opti FC Control Panel*

*About SPX Cooling Tech, LLC*

*SPX Cooling Tech is a leading global manufacturer of cooling towers, evaporative fluid coolers, evaporative condensers, industrial evaporators and air-cooled heat exchangers. Since 1922, its cooling systems and components, coupled with technical services, have supported applications in heating, ventilation and air conditioning (HVAC), refrigeration, and industrial process cooling. SPX Cooling Tech and its product brands are part of SPX Technologies, Inc. For more information, visit www.spxcooling.com.*

# Chiller & Cooling System Technology & Industry News

## Carrier Upgrades HVAC System Design Software

To meet the needs of HVAC design engineers, Carrier released a new version of Hourly Analysis Program (HAP), its peak load and energy modeling software. Carrier is a part of Carrier Global Corporation, the leading global provider of healthy, safe, sustainable and intelligent building and cold chain solutions.

To reduce the time and effort required to create high-quality building models, HAP v6 combines a streamlined workflow with an extensive array of advanced 3D building modeling features, all woven into a core design that continues to be easy to learn and use.

"Throughout the development process, Carrier worked directly with engineers in mechanical, electrical and plumbing (MEP) design firms," said Jim Pegues, eDesign Software Development Manager, Carrier. "Some were using previous versions of HAP and some were users of other system design applications. We focused on the ways engineers actually work, and listened to what they like and don't like about their current software."

Out of the discussions with consulting engineers, design/build contractors, HVAC contractors and facility engineers arose the key features and approach for HAP v6. New powerful features were added for graphically defining the building model. An engineer sketches over building floor plans to define boundaries of rooms, and the software automatically calculates dimensions and areas.

HAP v6 offers many technical upgrades to reduce what used to take a few days of labor to a couple hours of engineering time for building model creation. It integrates with the U.S. Department of Energy's EnergyPlus calculation engine to provide cutting edge system simulation capabilities. It utilizes the ASHRAE Heat Balance load calculation method to represent building physics more accurately.

A global weather library including 7,400 stations is included. Existing features for modeling the energy performance of modern HVAC equipment and controls have been upgraded to help building owners better meet their sustainability and environmental targets for greenhouse emissions.

Most current users can transition to HAP v6 for free at their own pace, continuing to use the current HAP v5 as long as necessary.

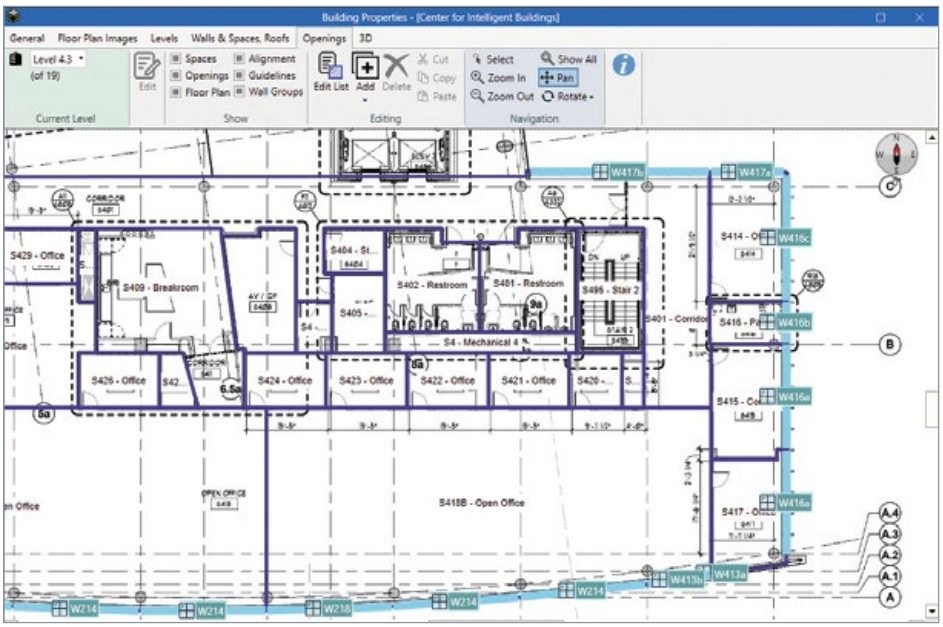
*About Carrier*

*Founded by the inventor of modern air conditioning, Carrier is a world leader in high-technology heating, air-conditioning and refrigeration solutions. Carrier experts provide sustainable solutions, integrating energy-efficient products, building controls and energy services for residential, commercial, retail, transport and food service customers. Carrier is a part of Carrier Global Corporation, the leading global provider of healthy, safe, sustainable and intelligent building and cold chain solutions. For more information, visit www.carrier.com.*

## EVAPCO Introduces New XPak Fill

New XPak Fill is offered for EVAPCO AXS cooling towers. The new PVC media, a bonded block fill, provides the greatest capacity in a factory-assembled cooling tower – when compared to other cooling towers with a 12- by 22-foot, or a 24- by 24-foot footprint – offering a range of capacity from 312 to 1,405 nominal tons. The company's Velocity Recovery Stack option provides an additional increase in thermal capacity.

AXS induced-draft, crossflow cooling towers are independently certified by the International Building Code to withstand seismic and wind load forces in North America, and also independently certified by the Cooling Technology Institute.




*The new version combines advanced automation with a streamlined, customizable workflow.*

*New XPak Fill is offered for EVAPCO AXS cooling towers.*

All EVAPCO sales representatives have more information about AXS 2.0.

*About EVAPCO*

*EVAPCO provides a full spectrum of global product solutions for the commercial HVAC, industrial refrigeration, power generation and industrial process markets with 78 active patents on the market today. 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 evapco.com.*

## Emerson to Sell Majority Stake in Climate Technologies Business

Emerson announced a definitive agreement under which it will sell a majority stake in its Climate Technologies business to private equity funds managed by Blackstone ("Blackstone") in a transaction valuing Climate Technologies at $14.0 billion. Emerson will receive upfront, pre-tax cash proceeds of approximately $9.5 billion while retaining a non-controlling ownership interest in a new standalone joint venture.

The standalone Climate Technologies business includes the market-leading Copeland compressor business and the entire portfolio of products and services across all HVAC and refrigeration end-markets, representing approximately $5.0 billion of fiscal 2022 sales.

The transaction marks a significant milestone in Emerson's journey to create a higher value, cohesive industrial technology portfolio and to become a pure-play global automation company serving a diversified set of end markets. Emerson, together with AspenTech, has the industry's most comprehensive portfolio of advanced automation technologies and software.

As a pure-play automation company, Emerson will be positioned for higher growth, with strong, differentiated capabilities to help customers pursue their sustainability and productivity objectives in process, hybrid and discrete industries. The Emerson portfolio is aligned with many of the world's secular growth drivers, including digital transformation, sustainability and decarbonization, and nearshoring. Following completion of the transaction, Emerson is expected to have industry leading margins, strong free cash flow generation and will continue to leverage Emerson's management process and operating discipline.

"Today's announcement is a definitive step in the portfolio journey we embarked on when I became CEO in early 2021," said Lal Karsanbhai, President and Chief Executive Officer of Emerson. "Over the past 18 months, the Emerson team has accelerated our portfolio transformation, divesting non-core businesses including InSinkErator and Therm-O-Disc, while investing in organic growth opportunities and important transactions including AspenTech."

"Our journey has been with clear purpose – to drive growth and significant value creation for our shareholders by creating a leading global automation company. Our differentiated capabilities in intelligent devices and software, and the focus, cohesiveness and operating agility of a pure-play company, will allow Emerson to bring our comprehensive automation products and solutions to a diverse set of end markets."

"This transaction enables Emerson to partially monetize our Climate Technologies business at an attractive valuation and provides significant upfront cash proceeds to invest in growth, while at the same time enabling Emerson to participate in Climate Technologies' upside potential upon exit of our non-controlling position," continued Mr. Karsanbhai. "We are excited to partner with Blackstone given its successful history of value creation in collaboration with corporate partners. We look forward to working closely with Blackstone

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to ensure a smooth transition for Climate Technologies' employees and customers."

Climate Technologies had fiscal 2022 net sales of $5.0 billion, pre-tax earnings of $1.0 billion and EBITDA, including standalone costs, of $1.1 billion. The transaction values Climate Technologies at $14.0 billion, representing a multiple of 12.7x fiscal 2022 EBITDA, including standalone costs. Emerson will receive upfront, pre-tax cash proceeds of approximately $9.5 billion and a note of $2.25 billion at close and retain 45% common equity ownership of the standalone Climate Technologies business, which will be structured as a joint venture between Emerson and Blackstone, until its potential sale or IPO. The cash consideration will be funded by $5.5 billion of fully committed debt financing ($6.2 billion inclusive of an unfunded ABL facility) and $4.4 billion of equity contribution from Blackstone. A wholly owned subsidiary of the Abu Dhabi Investment Authority (ADIA) and GIC will invest alongside Blackstone as part of the transaction.

Emerson expects to invest the proceeds from the transaction in strategic M&A to strengthen and diversify its automation portfolio in four targeted adjacent markets, which will be discussed at Emerson's investor conference on November 29, 2022. Emerson also expects to continue to return cash to shareholders through share repurchases, expected to be approximately $2 billion in 2023, and its dividend.

The transaction has been unanimously approved by Emerson's Board of Directors and is expected to close in the first half of the calendar year 2023, subject to regulatory approvals and customary closing conditions.

As part of the transaction, Emerson will be right sizing its corporate and platform cost structure and will sell ownership of its St. Louis, Missouri campus to the joint venture. Emerson will enter a three-year lease on the headquarters with an option to extend a further two years. During that time, Emerson will undertake a comprehensive assessment of potential headquarters locations.

*About Emerson*

*Emerson is a global technology and software company providing innovative solutions for the world's most essential industries. Emerson is an automation leader that helps process, hybrid and discrete manufacturers optimize operations, protect personnel, reduce emissions and achieve their sustainability goals through its unmatched automation portfolio, including its majority stake in AspenTech. For more information, visit www.emerson.com.*

### Baltimore Aircoil Releases its First ESG Report

Baltimore Aircoil Company (BAC), a worldwide leader in cooling solutions for the commercial, manufacturing, and industrial markets, announces the release of its 2021 Environmental, Social and Governance (ESG) Report. The ESG Report highlights the key initiatives, accomplishments, and targets necessary to achieve BAC's vision of reinventing cooling to sustain the world.

"We are very proud to publish our inaugural ESG Report where we, as the global leader in evaporative cooling, the most sustainable cooling technology in the market, have an obligation to innovate and lead the industry towards a more sustainable future," said Don Fetzer, President of BAC. "Our ESG Report is one building block to our mission of advancing truly sustainable cooling – inspired by nature and powered by our people."

As the world faces increasing challenges, our customers, suppliers, employees, and other stakeholders are seeking companies with sustainable practices. In support of these inherent requirements, BAC has established five areas of focus for sustainability-related efforts:

1. Develop and offer sustainable products
2. Design and operate our facilities to minimize environmental impact
3. Partner with suppliers to cultivate a sustainable supply chain
4. Elevate diversity, equity, inclusivity, and safety in our work environment to enable our employees to grow and make a positive impact on communities

5. Be the recognized leading provider for sustainable heat transfer solutions

BAC provides full transparency to its current efforts and identified targets for the future. BAC began measuring the environmental impact of its facilities in 2015 and has established goals for 2030. "In 2021 renewable electricity represented 21% of our total electricity consumption and we expect to increase our renewable electricity usage to more than 50% in 2022. Decarbonizing our electricity supply step by step is one of the initiatives we take to achieve our target of reducing absolute Scope 1 and Scope 2 emissions by 50% by 2030. This is just one of our many goals to improve our future environmental impact," said Tim Vrints, BAC's Global Sustainability Leader.

This ESG Report also highlights BAC's commitment to diversity, equity, and inclusion. BAC is evolving to reflect the diversity of its communities, its workforce, and its customers. BAC has increased diversity within its leadership team, added novel resources for employee education around key diversity and inclusion topics, and implemented social responsibility initiatives into employees' everyday experience. As an employee-owned company, BAC's culture inspires individual thought and continues to drive sustainability focused initiatives.

BAC has identified how transparency and corporate accountability go hand-in-hand and are necessary for lasting change. To learn more about BAC's ESG Report and the progress made in 2021, please view the complete report at https://www.bacsustainability.com.

*For more information, visit www.baltimoreaircoil.com.*

## Carrier AquaEdge 19DV Chiller Line Expands to 1150 Tons

Carrier announced that it has expanded its award-winning AquaEdge 19DV water-cooled centrifugal chiller capacity range in North America. With capacity now up to 1150 tons, the AquaEdge 19DV can accommodate customer requirements of higher capacity applications such as commercial high rise and mixed use buildings, large manufacturing factories and healthcare facilities. The AquaEdge 19DV is the ultimate innovation in chiller technology and utilizes a refrigerant with an ultra-low global warming potential of ~1. Carrier is a part of Carrier Global Corporation, the leading global provider of healthy, safe, sustainable and intelligent building and cold chain solutions.

"The AquaEdge 19DV is built on the legacy of Willis Carrier's breakthrough invention of the centrifugal chiller, which is celebrating its 100th anniversary this year," said Tom Franaszek, Director, Global Product Management, Water-cooled Chillers, Carrier Commercial HVAC. "The 19DV's unique EquiDrive two-stage back-to-back compressor design improves efficiency and operating range, continuing Carrier's technological leadership in centrifugal chiller design."

The AquaEdge 19DV was designed to minimize environmental impact while also providing industry leading efficiency. It also provides free cooling, a strategy for leveraging natural air temperatures, which can result in thousands


*The Carrier AquaEdge 19DV water-cooled centrifugal chiller with capacity now up to 1150 tons.*

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of dollars in energy savings per year while reducing maintenance costs and mechanical room space. The efficient design supports Carrier's 2030 ESG goal to reduce its customers' carbon footprint by more than 1 gigaton.

Additional features include a variable frequency drive (VFD) that protects the chiller against abnormalities in the power quality being delivered to a system. In addition, every 19DV is supported by Carrier's BluEdge service platform, providing actionable analytics and real-time dashboards. Carrier Service automatically trends, predicts and analyzes performance, allowing for a strategic approach to preventive maintenance and providing an intuitive way to monitor plant energy consumption.

The innovative AquaEdge 19DV first launched in Asia in 2016 and was subsequently introduced to other regions, earning a reputation for reliability and efficiency. The chiller has amassed an impressive list of more than five international accolades.

*For more information, visit carrier.com.*

### FRIGEL and HBR Sign Agreement to Consolidate Position in Latin America

HBR Máquinas e Equipamentos (HBR) and Frigel Firenze (FRIGEL) announced they have signed a joint venture agreement to engage in the manufacturing and sales of patented adiabatic cooling systems, high performance chillers and special solutions.


According to the JV terms, HBR and FRIGEL will secure equal share positions on Frigel Latinoamerica Ltda., with focus on technology application for water and energy savings in process cooling.

"According to the World Economic Forum, the gap between global water supply and demand is projected to reach 40% by 2030 if current practices continue. In many places, demand is already exceeding sustainable supply, and in others, lack of water is hindering economic growth. It is mandatory for today's companies to look for greener and smarter solutions, and the joint venture portfolio will focus on that," said Alessandro Moroni, CEO of Frigel Firenze.

The JV also consolidates the relationship between HBR, REFRISAT and FRIGEL, creating the largest Brazilian group for process cooling and temperature control for industrial applications, with manufacturing facilities in Guarulhos, São Paulo and Jundiaí. "Today's announcement expands our strategy started in 2019 with the acquisition of REFRISAT, a leading provider of high-quality chillers and thermoregulators for Latin America. The JV will provide outstanding synergies for technological exchange, global procurement, R&D and sales channels," said Daniel Cueva, HBR Sales & Marketing Director.

Frigel Latinoamerica will provide solutions for several industries, such as Plastic & Rubber, Food & Beverage, Power Generation & Transmission, Data Centers, Chemical & Pharma, Metals, and others.

### *About FRIGEL*

*The Frigel group is made up of Italian and foreign companies whose purpose is the design, production, installation, sales and service of systems & solutions for process cooling and temperature control. The Frigel group includes several manufacturing facilities as well as sales, engineering and service sites in Italy, Germany, Poland, USA, Thailand and India. For more information, visit www.frigel.com.*



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