Sustainable, Safe & Reliable On-Site Utilities Powering Automation

COMPRESSED AIR | CHILLER & COOLING BEST PRACTICES

airbestpractices.com

coolingbestpractices.com

June 2024

ASHRAE 90.1-2022 Section 10.4.6

Increase Efficiency with a Playlist of Industry

What do air compressors, chillers, and aeration blowers all share? Well, maybe nothing unless you take advantage of connectivity and compatibility to enhance your plant's energy efficiency. With Atlas Copco, you are guaranteed innovation in every step and equipment that works in perfect harmony. Choose Atlas Copco — the playlist of industry!

866-472-1013 | www.atlascopco.com/air-usa

COMPRESSED AIR SYSTEM FEATURES

COOLING SYSTEM FEATURES

EVERY ISSUE

Compressed Air Best Practices® (USPS# 17130) is published monthly except January-February combined by Smith Onandia Communications LLC, 37 McMurray Rd., Suite 104, Pittsburgh, PA 15241. Periodicals postage paid at Pittsburgh, PA and additional mailing offices. POSTMASTER: Send address changes to: Compressed Air Best Practices®, 37 McMurray Rd, Suite 104, Pittsburgh, PA 15241.

FROM THE EDITOR

An Efficiency Standard Covering Compressed Air and Cooling Systems

Our June 2024 issue features an article on ASHRAE 90.1-2022's new Section 10.4.6, which outlines minimum compressed air efficiency standards for "non-residential" buildings. While the standard was published almost two years ago, a major engineering firm brought it to our attention recently looking for clarification on a specific point.

Asking around the compressed air industry, I haven't yet run into someone who was already aware of the new section's existence. Our new Senior Editor, Troy Dreier, interviewed the Chairs of this ASHRAE 90.1 Committee to learn more about it. It will be interesting to see how it evolves.

Thanks to the System Assessment Section of the Compressed Air & Gas Institute (CAGI) for the article titled "CAGI Personnel Certification." What a great tool CAGI has created to develop the knowledge of employees.

Speaking of CAGI tools, our entire staff has been taking CAGI's "Foundations of Efficient Compressed Air Systems" e-learning course. Our team has found it extremely educational and challenging. I highly recommend it to all our subscribers!

We have articles from two of the most active cooling and compressed air system auditors in the U.S.: Clayton Penhallegon has sent us "Holistic Controls for Superior Cooling System Efficiency, Part 2," and Don Van Ormer has sent in an audit story titled "Four Compressed Air Demand Reduction Projects."

We are now accepting speaker abstracts for the Best Practices 2024 EXPO & Conference taking place October 29-31 in Atlanta at Cobb Galleria. Please mark your calendars and plan to visit us. If you'd like to speak, visit https://cabpexpo.com/conference/speaker-submission/.

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

RODERICK M. SMITH
Editor
tel: 412-980-9901
rod@airbestpractices.com

BEST PRACTICES EXPO & CONFERENCE CABPEXPO.COM
COMPRESSED AIR / VACUUM / COOLING

CAGI Compressed Air & Gas Institute

COOLING TECHNOLOGY INSTITUTE

2024 MEDIA PARTNERS

KELTEC Technolab

3 Year Bumper - to - Bumper Warranty

The best dryers in the industry now come with the best warranty in the industry!

KELTEC Technolab
2300 E. Enterprise Pkwy
Twinsburg, OH 44087
1-(330) 425-3100

KELTEC Technolab

website: www.keltecinc.com
email: sales@keltecinc.com

ISO 9001:2015 Certified

Compressed Air Technology & Industry News

FS-Elliott Bolsters Leadership Team with Strategic Appointments

FS-Elliott continues to grow and adapt to today's market by announcing some new position changes to fortify its commitment to excellence. The company has appointed Everson De Campos, Jimmy Tang and Albert Gomez to the team.

Everson De Campos has recently joined FS-Elliott as the new Executive Vice President, transitioning from a distinguished 14-year tenure at FS-Curtis. With a comprehensive background in the compressed air industry spanning over 25 years, he brings valuable expertise and leadership to the team. FS-Elliott looks forward to having him on the team to help the Centrifugal Business Unit Leadership team fulfill new goals for 2024.

New Executive Vice President – Everson De Campos.

Jimmy Tang has been appointed as the new Executive Vice President of Global Sales. He has worked at FS-Elliott for two years, overlooking the worldwide sales of FS-Elliott's industrial units and aftermarket businesses. Jimmy brings a background of over 25 years in P/L management, sales, marketing, aftermarket services, business development, supply chain and general management. This background makes him a well-rounded addition to the team.

Albert Gomez is taking over as the newest Vice President of Global Services. Albert brings four years of experience as the Director of Sales, Global Services and Aftermarket, with over 25 years in the compressed air industry.

"We are excited to update our team with these three professionals who will work hard to continue FS-Elliott's vision and success," says Paul Brown, CEO of FS-Elliott. "Each of them brings a wealth of knowledge that will drive our commitment to operational excellence, innovation and global market leadership."

New Executive Vice President of Global Sales – Jimmy Tang.

New Vice President of Global Services – Albert Gomez.

About FS-Elliott Co., LLC

FS-Elliott is a global leader in the engineering and manufacturing of oil-free, centrifugal compressors, with operations in over 90 countries. For 60 years, FS-Elliott has combined commitment to quality with advanced technology so our customers can increase their productivity and lower system operating costs. For more information, visit https://www.fs-elliott.com.

OTC Industrial Technologies Opens New Cleveland Branch

OTC has opened a new location in Cleveland, Ohio, which combines two of OTC's industrial businesses, air supply and industrial, automation and finishing in a 23,000-square-foot office, warehouse, and service and repair center.

OTC Industrial Technologies is an industrial equipment service provider and distributor headquartered in Columbus, Ohio. OTC is a market leader in OEM distribution from top-tier manufacturers, providing custom-engineered and technical solutions. The new Cleveland branch focuses on industrial compressed air, automation, finishing, dispensing and filtration products and services.

"We've provided air compressors, equipment services, and preventative maintenance for customers throughout the Midwest for more than 45 years. The longevity of our relationships says a lot about our technical expertise and superior customer service," said Adam Gibbs, President of OTC's Air Supply Group. "Our new service center is centrally located and stocks many common repair parts – combined with our onsite repair capabilities, we can respond quickly to customers."

Along with industrial air compressor sales of up to 250 hp and service and rental options for quality, consistent compressed air, air supply offers the premier product in reliable

compressed air – DIRECTAIR®, an air utility service solution.

OTC's industrial, automation and finishing business focuses on providing efficient and cost-effective solutions for finishing, filtration and dispensing needs within the manufacturing production process.

"We have listened to the feedback of our customers in Ohio and are thrilled to announce that we have established local finishing and filter inventory and repair capabilities in Cleveland," said Bob Wilson, President of OTC's Industrial, Automation and Finishing Group. "Our new site will enable our dedicated team to collaborate more effectively with our vendor partners and serve these important customers with even more care and compassion."

OTC INDUSTRIAL TECHNOLOGIES

OTC's new branch in Cleveland, Ohio, focuses on industrial compressed air, automation, finishing, dispensing and filtration products and services.

About OTC Industrial Technologies

Established in 1963, OTC Industrial Technologies is one of the largest industrial distributors and service providers in the United States. OTC provides expert solutions for industrial motion control, factory automation, fluid power, pumping systems, spray finishing, power transmission and compressed air systems. OTC operates a broad geographical footprint and delivers value to customers through its primary operating brands and divisions including OTP Industrial Solutions, AAP Automation, Air Technologies, Advanced Industrial Products, American Industrial Corporation, Buckeye Pumps, C&C Industrial Sales, Compressed Air Systems, Contrast Equipment, Crimson Electric, Critical Rental Solutions, Diversified Pump, Filter and Coating Technology, Furey Filter and Pump, IDG Compressor, Industrial Process Equipment Group, Keller Electrical, Laron, Midway Industrial Supply, Ohlheiser, PK Controls, Pumps, Parts & Service (PP&S), PumpTek, PSI Engineering, Tape Industrial Sales, TP Pump and Tri-Power MPT. For more information, visit https://otcindustrial.com.

Compressed Air Technology & Industry News

Hitachi Global Air Power Launches Sullair TS Series

Hitachi Global Air Power US, LLC, an industry leader in innovative compressed air solutions, announced the launch of the Sullair TS 190-260 Series two-stage rotary screw air compressors. Engineered for excellence, the TS Series offers best-in-class efficiency based on the most recent* efficiency data published in accordance with the Compressed Air and Gas Institute's third-party verification program.

The heart of the Sullair TS Series is an all new two-stage air end with patent-pending inter-stage cooling and an over/under design allowing for a smaller footprint.

"The Sullair TS Series is changing the game in the industrial compressed air market," said John Randall, President and CEO of Hitachi Global Air Power. "Our goal is to design machines that answer customers' needs – particularly the need for higher efficiency – and our engineers delivered. The redesigned two-stage air end sets a higher standard for efficiency and is another step forward in our new era of customer-centric, environment-forward innovation. It truly represents Hitachi ingenuity at its finest."

The Sullair TS 190-260 Series receives high marks for efficiency, performing markedly better than all comparable two-stage rotary screw air compressors participating in CAGI third-party verification. Efficiency, along with reliability, are important considerations in compressed air systems. Compressed air is widely used in industrial manufacturing and is often referred to as the fourth utility; it can account for as much as 10% of a facility's energy costs. Hitachi Global Air Power engineers meticulously designed the TS Series to both enhance efficiency and to minimize greenhouse gas emissions in the compressors' production.

"Achieving significant efficiency improvements in our compressed air products helps not only the environmental impact of our customers' operations, but their bottom line as well," said Tom Poczekay, Vice President Engineering at Hitachi Global Air Power. "The Sullair TS Series is such an exciting product because we totally re-thought the way a

Hitachi Global Air Power introduces the Sullair TS Series industrial air compressors with best-in-class efficiency.*

two-stage compressor moves and compresses air, not only dramatically increasing the efficiency but doing so while maintaining – and even building on – our foundation of bulletproof reliability and durability."

The Sullair TS Series comes in either air- or water-cooled configurations with standard fixed speed, variable speed or with Sullair-exclusive electronic spiral valve technology, which matches compressor supply with demand and can tolerate harsh or dirty environments. The intuitive 10-inch color touch screen controller with expanded capabilities comes standard on all TS Series models. With fewer parts, the TS Series package is designed for easy service and maintenance and is ideal for large industrial applications, including steel, auto manufacturing and more.

*Based on current (March 2024) efficiency data published in accordance with CAGI third-party verification program.

About Hitachi Global Air Power US, LLC

We are Hitachi Global Air Power, a leading global industrial compressed air manufacturer. Headquartered in Michigan City, Indiana, our compressed air solutions power manufacturing operations all around the globe: from food and beverage to pharmaceuticals and computer chips. Our portable compressors provide the air power to build roads and bridges, lay pipelines and aid in oil and gas mining and production. As part of Hitachi Industrial Equipment Systems Co., Ltd., Hitachi Global Air Power operates ISO 9001 certified factories in Michigan City, Indiana and Suzhou, China, and sales offices strategically located in Europe, Australia, Southeast Asia, and South and Latin America. Through brands Hitachi, Sullair and Champion (Australia), our machines have provided legendary reliability, durability and performance for more than 59 years. For more information, visit https://www.hitachiglobalairpower.com.

Compressed Air Technology & Industry News

About Hitachi, Ltd.

Hitachi drives social innovation business, creating a sustainable society through the use of data and technology. We solve customers' and society's challenges with Lumada solutions leveraging IT, OT (Operational Technology) and products. Hitachi operates under the business structure of "Digital Systems & Services" – supporting our customers' digital transformation; "Green Energy & Mobility" – contributing to a decarbonized society through energy and railway systems, and "Connective Industries" – connecting products through digital technology to provide solutions in various industries. Driven by digital, green and innovation, we aim for growth through co-creation with our customers. The company's consolidated revenues for fiscal year 2022 (ended March 31, 2023) totaled 10,881.1 billion yen, with 696 consolidated subsidiaries and approximately 320,000 employees worldwide. For more information, visit https://www.hitachi.com.

Quincy Debuts QDS Odyssey Oil-Free High-Pressure Boosters

In the world of industrial machinery and compressed air solutions, reliability and performance are paramount. Quincy Compressor, a leading designer and manufacturer of reciprocating and rotary screw air compressors, is proud to unveil its latest game-changer: The QDS Odyssey oil-free high-pressure reciprocating boosters.

Quincy Compressor's QDS Odyssey oil-free high-pressure reciprocating boosters are designed to meet the demands of the most rigorous applications. Boasting standard capabilities of up to 600 psig and 500 scfm for both air and nitrogen, these boosters are engineered to deliver exceptional performance consistently. What sets them apart is their reliability – a feature that's non-negotiable in critical industrial settings.

Crafted with precision in the USA, the Odyssey series embodies innovation and reliability. Each booster is designed to handle diverse applications, ensuring optimal industry performance. Ranging from 5 to 75 hp, these boosters can be configured to suit specific needs, with the option to double output or add redundancy in duplex configurations.

The applications of the QDS Odyssey oil-free high-pressure reciprocating boosters span across numerous industries, including:

- Food and beverage: Ensuring product quality and safety through air and gas compression.
- Manufacturing: Powering various manufacturing processes with reliable solutions.
- PET bottle blowing and conversion: Facilitating efficient PET bottle production with consistent air pressure.
- Fabrication and nitrogen laser cutting: Enabling precision cutting operations with high-pressure nitrogen and eliminating the risk of costly oil contamination.
- Starting air: Providing dependable starting air for engines in marine and offshore applications.
- Ultra-pure cleaning: Supporting critical cleaning processes with contaminant-free compressed air.
- Renewable natural gas "biogas": Boosting the production of renewable energy sources through efficient gas compression.

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. For more information, visit https://www.quincycompressor.com.

Quincy Compressor launches QDS Odyssey oil-free high-pressure reciprocating boosters.

SMC

Automation - Controls - Process

Tired of downtime & scrap as a result of poor compressed air quality?

Moisture is found in compressed air lines & exhausting from valves & actuators on equipment, thereby reducing component life and machine efficiency.

Tired of draining water & oil from your compressed air lines every spring , as well as cleaning or replacing pneumatic components well before their lifespan?

The Solution:

Remove the Moisture

The SMC Dryer Advantage

- **Environmentally friendly R124a/R407C refrigerant**
- **Simple control system, incorporating easy to read evaporator gauge**
- **Stainless steel heat exchanger providing long-life & low-pressure drops**

SMC Dryers provide low energy consumption & efficient operation in sizes to work with air compressors from 1/3 to 100 horsepower (0.24kW to 75kW) & flow ranges from 10 scfm to 400 scfm.

Air Management System

Level up your sustainability, digitalization, & condition-based maintenance

- **Save energy and improve sustainability**
  Programmable automatic pressure reduction and shut-off times
- **Enhance your maintenance capabilities**
  Measurement and follow-up of flow, pressure and temperature

Providing Sustainable, Energy Efficient and CO_2 Reducing Components for Industrial Automation

SMC Corporation of America (800) SMC.SMC1 (762-7621) www.**smcusa**.com

SMC Automation (Canada) Ltd. (800) SMC.SMC1 (762-7621) www.**smcautomation**.ca

Energize Your Efficiency

Compressed Air Technology & Industry News

Atlas Copco Industrial Air Launches First Dual-Speed Compressor

Atlas Copco Industrial Air is launching GA 11-30 FLX, which is its first dual-speed compressor. Thanks to the dual-speed technology, the start-up peak, unload power and transient losses are significantly lower than the ones in its other fixed-speed compressors. This means that up to 20% less energy is needed compared to Atlas Copco Industrial Air's traditional fixed-speed compressors, making the GA FLX its most energy efficient fixed-speed product. The compactness of the product and the fact that the GA 11-30 FLX can deliver optimal flow at all different pressures and not just a specific pressure variant, are what make this product so unique.

The idea of GA 11-30 FLX originated from the increasing market demand for more energy-efficient products. Considering the energy crisis during the winter of 2022, the market is now aware more than ever of the financial benefits of a more sustainable product, saving energy and therefore extra costs.

Atlas Copco Industrial Air's newest compressor, GA 11-30 FLX, has a significant impact on clients' energy usage and the environment. With its dual speed drive train and motor, the start-up peak, unload power and transient losses are significantly lower than the ones in its traditional fixed-speed compressors.

More specifically, this means that up to 20% less energy is needed compared to Atlas Copco Industrial Air's traditional fixed-speed compressors. Seeing as worldwide 5% of energy is used up by compressors, this product reduces its global impact.

On top of that, its actual footprint is also an innovative feature in Atlas Copco Industrial Air's fixed-speed compressor category. The drive train set of this compressor is placed vertically, making the footprint of the compressor much more compact and thus saving a lot of space.

Joeri Ooms, Divisional President Atlas Copco Industrial Air said, "At Atlas Copco Industrial Air, we work towards a more sustainable world every day. We are the cradle where tomorrow's

Atlas Copco Industrial Air's most energy efficient fixed-speed compressor uses up to 20% less energy.

innovative industrial ideas are shaped, with focus on environment and people. GA 11-30 FLX is our best fixed-speed compressor and is our answer to client's demands for more energy efficiency."

Atlas Copco Industrial Air's experience shows the market does not only have a need for more energy efficient products, but also more flexible ones. Thanks to the GA 11-30 FLX, customers are not limited by the maximum working pressure of the compressor. The GA 11-30 FLX uses its power optimally to deliver as much air as possible at all set pressures, thus using the energy more efficiently and consequentially operating more sustainably.

Other fixed-speed machines only deliver optimal flow for their own pressure variant. As a result, higher pressure variants of their traditional fixed-speed compressors deliver less air at lower pressures and lower pressure variants cannot operate at higher pressures. The fact that GA 11-30 FLX can deliver optimal flow at all different pressures is what makes it so unique.

This product is a result of building on years of experience and proven technology that works and is reliable. Atlas Copco Industrial Air production teams are practicing lean manufacturing. In other words, they can optimally follow the demand seeing as they can alter the production process quickly if need be. Training, attention to details and multiple tests are central during the production process to guarantee the best possible quality.

Joeri Ooms said, "Our customers' insights were considered in every step of the development of the compressor, thanks to the involvement of our local sales offices, also known as our customer centers. We are very proud of the in-house design of all the principal components of this product, which is a result of efficient collaboration between all the Atlas Copco cross functional teams and colleagues globally."

About Atlas Copco Group

Atlas Copco Group enables technology that transforms the future. We innovate to develop products, services and solutions that are key to our customers' success. Our four business areas offer compressed air and vacuum solutions, energy solutions, dewatering and industrial pumps, industrial power tools, and assembly and machine vision solutions. In 2022, the Group had revenues of BSEK 141, and 49,000 employees. For more information, visit https://www.atlascopcogroup.com/en.

About Industrial Air

Industrial Air is a division within Atlas Copco Group, and part of the Compressor Technique Business Area. We develop, manufacture and market compressed air and gas generation solutions to maximize productivity in the general industry as well as marine and railway industries. The innovative technologies used in our products, such as compressors, air treatment and filtration solutions, oxygen and nitrogen generators, and boosters, enable energy efficiency solutions and deliver value for our customers. We are headquartered in Antwerp, Belgium, with additional production in Italy, China, Brazil, India, France, Netherlands, Slovakia, Turkey, United Kingdom and the United States.

Compressed Air Technology & Industry News

Ivys named official distributor of KSI Technologies in Canada

Ivys Adsorption has signed a partnership agreement with Germany's KSI Technologies. Ivys has become an official distributor of KSI products in Canada, with exclusivity for the Quebec market. KSI designs and manufactures air filters, desiccant dryers and many other specialized products, benefiting Ivys's customers.

"We are thrilled to finally unveil our partnership with Ivys Adsorption in North America. With Ivys set to distribute the entire KSI product lineup throughout Canada, having exclusive rights in Quebec, we are ready to embark on a journey of innovation and mutual success. Together, we are poised to leave a lasting impact on the compressed air industry across Canada. For KSI, this marks a milestone in our market expansion strategy across the Americas, and it motivates us to take the next strategic steps," said Mirko Krebs, COO of KSI Technologies.

"We see this partnership with KSI as a win-win. The Canadian market will now have access to a wider range of solutions to achieve better results and performance. Access to the products best suited to our customers' applications is essential. With the addition of the Ecoclean, Ecotroc, Kondrain and Kontrec, and Ecocontrol ranges to our portfolio, Ivys is more than ever a key player in the air compressor and dryer market," said Michael Nadeau, Vice President, Finance and Industrial Business at Ivys.

About Ivys Adsorption Inc

Ivys offers both high-performance and innovative technological solutions for the purification of renewable gas and a wide range of equipment for the conditioning, compression, and filtration of air and gas. Ivys is part of the movement aiming to decarbonize the planet with a sustainable development model that integrates economic growth through social and environmental responsibilities. For more information, visit https://ivysads.com.

Kaeser Announces AQUAMAT i.CF

Kaeser Compressors, a leading innovator in compressed air system solutions, announced its new oil-water separator, designed to maximize efficiency, simplify maintenance and seamlessly integrate with modern industrial environments.

Unlike traditional gravity-fed systems, the AQUAMAT i.CF employs an active process using compressed air to more evenly distribute condensate throughout the filter. This innovative approach ensures environmental compliance while maximizing utilization of the filter media for longer service intervals. Ergonomic design and drip-proof cartridges offer fast, no-mess servicing.

The separator boasts the new intelligent AQUAMAT CONTROL that tracks cartridge life. Seamless connectivity via Modbus TCP allows real-time monitoring and proactive maintenance, ensuring optimal performance and preventing costly downtime. The controller also sends alerts when service is needed, maximizing cartridge life before replacement.

The AQUAMAT i.CF's innovative modular design allows customers to easily expand capacity to flows up to 3,300 scfm as their production grows with less capital outlay. Each added module uses the same cartridge, simplifying parts management and reducing service costs.

"Although the oil/water separator is a small part of the compressed air system, the new i.CF enhances the entire system by providing a more reliable condensate separation process with better monitoring and servicing functionality," said Justin Aycock, Air Treatment Product Manager.

The AQUAMAT i.CF with AQUAMAT CONTROL provides clean and effective condensate separation for flow rates up to 3,300 scfm.

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 http://us.kaeser.com.

ASHRAE 90.1 Brings New Requirements to Compressed Air Design

The energy efficiency standard adds compressed air specs for the first time, bringing engineers into system design

By Troy Dreier, Compressed Air Best Practices® Magazine

Word is beginning to filter out about the 2022 changes to the ASHRAE 90.1 energy efficiency standard, and the changes it promises to bring to how compressed air systems are specified, commissioned and maintained. More specifically, the industry is learning about section 10.4.6 of 90.1, which is the first time the standard has included a section on compressed air.

ASHRAE, the American Society of Heating, Refrigeration and Air-Conditioning Engineers, was founded in 1895. Part of the association's mission is to create standards that give guidance to U.S. construction. The 90.1 standard covers all sites and buildings except for low-rise residential buildings, and offers engineering firms minimum requirements for energy-efficient buildings. It includes chapters on the building envelope; heating, ventilating and air conditioning; service water heating; power; lighting and more. It was first created in 1975, and in 1992 it was included in the Energy Policy Act by Congress, giving it jurisdiction over much new construction.

As of January, 2023, the 90.1-2022 standard includes a new section numbered 10.4.6 that falls in the Other Equipment chapter, which also covers elevators, escalators and air curtains. The 10.4.6 section brings compressed air systems into this engineering almanac for the first time. *Compressed Air Best Practices* spoke to Richard Lord, ASHRAE fellow, committee chair of the 90.1-22 committee, and a senior fellow with Carrier, and Susanna Hanson, CEM, DGCP, director and regional chair of ASHRAE Region VI and principal R&D engineer and scientist for Honeywell, to learn

Richard Lord

Susanna Hanson

why this section was added and what it means for compressed air system design.

"Compressed air systems were added because compressed air can use a lot of energy, especially if it's not well-maintained," explains Lord "Having worked in a lot of manufacturing plants, maintenance of compressed air systems can be a very important thing to do. So we focus on picking some of those requirements."

The 90.1 standard is a combination of prescriptive and mandatory specifications. Any 90.1 section with a dot-four in it is mandatory, while dot-five sections are prescriptive, meaning the standard proposes one way of doing things, but engineers are free to differ. Also, 90.1 is a continuous maintenance standard, and will be modified and republished every three years, meaning 2025, 2028, and 2031 will see updated versions. ASHRAE forms its standards by setting a goal of a certain level of energy improvements. For the 2022 standard, the goal was to improve energy efficiency by 45% over the base year of 2004. The 10.4.6 section might be just a page-and-a-half (see the sidebar for details about what it includes), but it's supported by detailed addendums and technical documents.

"We have to prove cost justification," Lord says. "So we have an economic justification that shows that this will pay back in the life of the building or the life of the equipment. A lot of our equipment, at least the mechanical equipment, is also reviewed by the Department of Energy. So the Department of Energy has a mission to improve building efficiency that's defined by them under the Energy Policy Act of the United States."

The 10.4.6 section includes specifications on part-load efficiency, controls, monitoring, leak testing, and pipe sizing.

"We have to prove cost justification. So we have an economic justification that shows that this will pay back in the life of the building or the life of the equipment." – Richard Lord

Lord notes that the inclusion of monitoring can be hard to justify since it doesn't directly save energy, but it's useful for spotting problems before they get out of hand: "Hey, why is my energy in my compressed air system 20% greater this month than it was last month? Maybe we have a leak someplace."

No Love for New Regulations

California gets the credit for introducing legislation on air compressor efficiency, Lord says. "They start to look at their energy use and they say, 'Well, hey, here's an area that we have not tapped into." When you look at a manufacturing facility, compressed air is 20%, 30% of the energy load. What can we do to reduce that, just like we try to reduce the heating load, we try to reduce the cooling load?"

For those already chaffing at the idea of new regulations telling them how to do their work, it's useful to think of 90.1 as guidance and goals. "I hate people to tell me how to design my HVAC system or design my compressed air

ASHRAE 90.1 Brings New Requirements to Compressed Air Design

A Closer Look at Section 10.4.6 on Compressed Air System Design

ASHRAE doesn't allow its standards to be reprinted, but the following paraphrase explains what section 10.4.6 of the 90.1-2022 standard contains. For the exact wording, visit www.ashrae.org.

10.4.6 The **introduction** explains that these requirements apply to compressed air systems in industrial locations, and apply to air compressors and related piping and controls but not to systems that use that compressed air.

10.4.6.1 The title of this part is **Part-Load Controls** and Efficiency. It requires that compressed air systems of 25 hp or more need to include one or more trim compressor(s) and primary storage. It then provides two options for compliance.

Option 1 says the system shall include one or more VSD air compressors. It provides sizing guidelines for trim compressors and primary storage. Option 2 requires that the total effective trim capacity of an air compressor system is within certain specific power (kW/100 acfm) parameters.

This part also includes exceptions to its trim requirements, which include systems that have been altered in specific ways or that include centrifugal compressors.

10.4.6.2 This part mandates the uses of energy-saving **controls** on systems that include three or more air compressors (including backups) with a total input power of over 150 hp.

10.4.6.3 This part mandates an energy and compressed air demand **monitoring** system for systems with input power of 150 hp or greater. The monitoring system needs to measure system pressure, measure or calculate current or power per air compressor, and measure or determine total airflow from all air compressors in acfm.

Data logging is required for a list of key performance indicators at intervals of five minutes or less. The equipment shall record not less than six months of data and provide exportable data. A visual trending data display is also required.

10.4.6.4 Piping **leak testing** is mandatory. This part explains how compressed air system piping shall be pressure tested with a pressure loss requirement of equal to or less than 1.0%. For piping less than or equal to 50 feet in length, connections may be optionally tested with specific methods.

10.4.6.5 The last section includes specifications for **pipe sizing.** For new systems and additions to systems, the guideline for headers and distribution piping is to minimize frictional losses. For service line piping to end uses, piping inner diameters shall be greater than or equal to 1 inch. Replacement piping in existing systems shall also meet these requirements.

system. But if we can set goals and we can set metrics, then our firm can come in and say, 'My new system is 20% more efficient than the system you have in there.' It gives you a way to sell new products and upgrade systems."

Are these specifications mandatory? What happens to firms that choose not to follow them? The answer is it depends. As Hanson points out, there are no police enforcing this. Even though some of the code is specified as mandatory, there's no enforcement built in. This is the standard of care for engineering professionals, she notes, and they're expected to design to these standards. If they aren't followed, the Department of Energy might recognize that some states are lagging in their energy efficiency goals and make an effort to get those states up to the level of the other states. With that said, some parts of the country make 90.1 compliance a prerequisite for getting building permits, so building without following the standard's specs wouldn't be possible.

"Manufacturers don't really like having multiple rules in different jurisdictions, and so manufacturers typically will also drive a harmonization by just having products that meet whatever the manufacturer can do," Hanson says. "There's a lot in here that the engineer has to do, but the parts that are done by manufacturers, a lot of times that gets done for the states. The market kind of moves almost in a disjointed way from where the codes are, just by virtue of wanting to have economies of scale, and the production of that equipment."

Enter the Engineer

One result of the addition is that engineers will now likely play a larger role in planning compressed air systems, which could lead to integrated heat recovery solutions that harness and use the energy now lost to heat of compression. As Hanson notes, there have now been a generation or two of engineers who don't have much to do with the compressed air sides of commercial buildings, their compressed air skills having atrophied after buildings went from using pneumatic controls to electrical controls. Smaller engineering firms may not have compressed air knowledge,

BLOWER & VACUUM BEST PRACTICES blowervacuumbestpractices.com

COMPRESSED AIR BEST PRACTICES airbestpractices.com

CHILLER & COOLING BEST PRACTICES coolingbestpractices.com

PROUDLY PRESENTING THE 2024 EXPERT WEBINAR SERIES

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

Todd Dunn
Vice President Sales & Marketing, Zorn Compressor & Equipment

Mike Flowe
President, Flowe Nitrogen Systems

Emma Larrabee
Marketing Manager, Zorn Compressor & Equipment

Mike Womack
Thermal Certification Administrator, Cooling Technology Institute

Andy Smiltneek
President, Growth Solutions Consultants

Don Van Ormer
Auditor, APEnergy

JAN 11
How to Boost the Energy Efficiency of Rotary Screw Air Compressors
Presenter Andrew Smith, P.E., Co-Founder, SMARTCAir – *Sponsored by FS-Curtis/FS-Elliott*
Thursday, January 11, 2024 – 2:00PM EST

JAN 25
ASME PTC13 in Action: Practical Approach to Blower System Performance Testing
Presenter Julie Gass, Lead Mechanical Process Engineer, Black & Veatch and Hiran de Mel, Senior Project Manager and Principal Technologist, Jacobs – *Sponsored by Inovair*
Thursday, Jan 25, 2024 – 2:00PM EST

FEB 08
Centrifugal vs Rotary Screw Air Compressor Performance: Full Load and Part Load Efficiency
Presenter Mike Lenti, Senior Auditor, Compressed Air Consultants – *Sponsored by Rogers Machinery*
Thursday, February 8, 2024 – 2:00PM EST

FEB 22
Storage Tank and Pipe Sizing for Large Plants: How to Meet CFM Needs
Presenter Ron Marshall, Chief Auditor, Marshall Compressed Air Consulting – *Sponsored by Unipipe*
Thursday, February 22, 2024 – 2:00PM EST

MAR 07
Sizing Vacuum Pumps and Piping for Various Applications
Presenter Andy Smiltneek, President, Growth Solutions Consultants – *Sponsored by Busch Vacuum Solutions*
Thursday, March 7, 2024 – 2:00PM EST

MAR 21
Control of Distributed Systems with Multiple Air Compressor Rooms
Presenter Tim Dugan, P.E., President, Compression Engineering Corporation – *Sponsored by CALMS Air and Comate Intelligent Sensor*
Thursday, March 21, 2024 – 2:00PM EST

APR 04
Refrigerated vs. Desiccant Dryers – Choosing the Right One
Presenter Don Van Ormer, Auditor, APEnergy – *Sponsored by Trace Analytics and BEKO Technologies*
Thursday, April 4, 2024 – 2:00PM EST

APR 18
CTI STD-201RS Thermal Certification for Cooling System Heat Rejection Equipment Part 2
Presenter Mike Womack, Thermal Certification Administrator, Cooling Technology Institute – *Sponsored by American Cooling Tower*
Thursday, April 18, 2024 – 2:00PM EST

MAY 09
How to Identify and Eliminate Artificial Demands
Presenter Tom Taranto, Owner, Data Power Services – *Sponsored by Kaishan*
Thursday, May 9, 2024 – 2:00PM EST

MAY 23
Sensors for Compressed Air Systems: Data Management and Analysis
Presenter Andrew Smith, P.E., Co-Founder, SMARTCAir – *Sponsored by VPInstruments and Kaeser Compressors*
Thursday, May 23, 2024 – 2:00PM EST

JUN 06
Optimize your Compressed Air System with Proper Maintenance
Presenter Ron Marshall, Chief Auditor, Marshall Compressed Air Consulting – Sponsored by Kaishan
Thursday, June 6, 2024 – 2:00PM EST

JUN 13
Advanced Aeration Control for Blowers
Presenter Tom Jenkins P.E., President, JenTech Inc. – *Sponsored by APG-Neuros*
Thursday, June 13, 2024 – 2:00PM EST

JUN 20
Simultaneous Cooling & Heating System Design
Presenter Phil Johnston, P.E. Technical Manager, Woodard & Curran
Thursday, June 20, 2024 – 2:00PM EST

JUL 18
How to Determine the Optimal Size of a Nitrogen Generator
Presenter Mike Flowe, President, Flowe Nitrogen Systems – *Sponsored by Pneutech*
Thursday, July 18, 2024 – 2:00PM EST

JUL 25
Instrumentation and Monitoring for Vacuum Systems
Presenters Emma Larrabee, Marketing Manager and Todd Dunn, Vice President Sales & Marketing, Zorn Compressor & Equipment – *Sponsored by Quincy Compressor*
Thursday, July 25, 2024 – 2:00PM EST

AUG 08
How to Diagnose and Fix Common Issues in Rotary Screw Air Compressors
Presenter Tom Taranto, Owner, Data Power Services – *Sponsored by FS-Curtis/FS-Elliott*
Thursday, August 8, 2024 – 2:00PM EST

AUG 22
Thermal Performance of Evaporative and Dry Cooling Systems
Presenter Clayton Penhallegon, Jr., PE, Integrated Services Group – *Sponsored by EVAPCO*
Thursday, August 22, 2024 – 2:00PM EST

SEP 12
Aeration Blower Sizing and Selection
Presenter Tom Jenkins P.E., President, JenTech Inc. – *Sponsored by Kaeser Compressors*
Thursday, September 12, 2024 – 2:00PM EST

OCT 03
Selecting PSA vs. Membrane Nitrogen Generation Systems
Presenter Mike Flowe, President, Flowe Nitrogen Systems – *Sponsored by Pneumatech*
Thursday, October 3, 2024 – 2:00PM EST

OCT 10
How to Interpret Audit Data and Improve Your Compressed Air System
Presenter Mauricio Uribe, Auditor, Compressed Air Consultants – *Sponsored by Rogers Machinery and BEKO Technologies*
Thursday, October 10, 2024 – 2:00PM EST

OCT 17
Heat Recovery from Compressed Air Systems
Presenter Don Van Ormer, Auditor, APEnergy – *Sponsored by Kaishan*
Thursday, October 17, 2024 – 2:00PM EST

NOV 21
Power Consumption Curves for Vacuum Pumps: Fixed-Speed vs Variable-Speed
Presenter Andy Smiltneek, President, Growth Solutions Consultants – *Sponsored by Rogers Machinery*
Thursday, November 21, 2024 – 2:00PM EST

DEC 12
Compressed Air Leak Detection: Techniques, Methods, Tips, and Tools
Presenter Ron Marshall, Chief Auditor, Marshall Compressed Air Consulting – *Sponsored by Rogers Machinery and Teledyne FLIR*
Thursday, December 12, 2024 – 2:00PM EST

DEC 19
Selection Criteria for Oil-Free Air Compressors
Presenter TBD – *Sponsored by FS-Curtis/FS-Elliott*
Thursday, December 19, 2024 – 2:00PM EST

Register for Free Today at **airbestpractices.com**/webinars

Missed a Webinar? Register to View from our Archives at https://www.airbestpractices.com/webinars

SPONSORED BY

ASHRAE 90.1 Brings New Requirements to Compressed Air Design

but instead rely on the major compressed air manufacturers to design their systems.

"I think the same, more or less, happens in grocery refrigeration as well, where the manufacturers of the equipment assemble an engineering department that's registered in every state that they do business, and they do the designs," Hanson says. "I think there are elements of the industrial space that have been requiring the manufacturers of their systems to basically do designs for free, or as part of their regular cost of doing business, so what they charge for the equipment is also rolled into that. Maybe the more efficient way to do it is rather than educate every consulting engineer, you just educate the big manufacturers of this equipment and they do it that way. This becomes their standard practice. That would be potentially a faster way to move."

The inclusion of 10.4.6 to 90.1 is a first take at developing engineering guidelines for compressed air systems, but ASHRAE leadership is interested in refining its codes through feedback. Readers of *Compressed Air Best Practices* are welcome to get involved.

"This is our first shot at trying to put some regulations in there, but we have a process called a continuous maintenance proposal (CMP) process, which is a change proposal process," explains Lord. "Anybody in the industry can submit a change to 90.1 and then the committee will evaluate it. A lot of times what we do is we'll add on technical experts. So if you guys said, 'We'd love to help you guys come up with a better compressed air section in the standard,' we can bring you on as technical experts and we can form a sub-working group."

Readers who want to take Lord up on this and get involved can do so by submitting a continuous maintenance proposal at osr.ashrae.org/continuous-maintenance/create-proposal. A login is required.

"Saving energy has its own rationale," Hanson says. "It's not just for meeting code and doing what you have to do. 90.1, if you use it right, is a great roadmap for doing things that are cost justified, and are easier to get through your process internally, your process externally. It gives you air cover for chartering projects." BP

About ASHRAE

ASHRAE, founded in 1894, is a global society advancing human well-being through sustainable technology for the built environment. The Society and its members focus on building systems, energy efficiency, indoor air quality, refrigeration and sustainability within the industry. Through research, standards writing, publishing and continuing education, ASHRAE shapes tomorrow's built environment today. For more information, visit www.ashrae.org.

To read articles on ***Compressed Air Standards,*** visit www.airbestpractices.com/standards.

For expert presentations, visit our Webinar Archive Section dedicated to ***Air Compressor Technology*** at www.airbestpractices.com/webinars.

CAGI Personnel Certification: How to Have Your Own Personal Performance Verification Program

By CAGI System Assessment Section

An effective, efficient compressed air system requires proper system design and proper selection, installation and maintenance of the equipment in the system. CAGI provides information and training to assist with all these tasks, and CAGI members provide equipment designed to meet all sorts of end user needs. Manufacturers provide performance data and other information so end users are able to evaluate equipment and make intelligent choices.

CAGI sponsors and oversees a performance verification program for some types of equipment. In this program, which is expanding to include additional types of products, a third-party verifies performance data that is stated by manufacturers. Participants in these programs are able to use a standardized CAGI datasheet to state performance. The datasheets and verification process provide customers with assurance that they are getting what they pay for in terms of performance. The program also provides credibility to participating manufacturers, who stand by their data and are willing to put their reputations on the line through third party testing and verification.

While there is still room for expansion of activity related to verification of performance of equipment, and that expansion is being explored within CAGI, the existing CAGI programs address a large part of the market. Vetting of the equipment side of the equation has been addressed. What about the people? How can end users be sure the individuals who design and audit systems, who recommend and install equipment, who provide advice on system performance and optimization, are qualified and know what they are doing?

Experience and training/education are two means of gaining the requisite knowledge and abilities. CAGI and others provide many educational and training materials, including online training programs that provide a certificate of completion. CAGI partner, the Compressed Air Challenge, also provides online and in-person training that results in a certificate of completion.

Pursuing education and training is certainly laudable, and all compressed air system professionals should continue to educate themselves about compressed air systems and equipment; however, a certificate of completion is not a certificate of understanding. Education/training and a certificate of completion are the necessary first steps in the personal performance verification program journey. Showing up for training and receiving a certificate does not mean an individual has absorbed and understands the material they need to know in order to meet the needs of their compressed air system end user customers.

Similarly, a long tenure in the industry is not a guarantee of capability and understanding. A long career as an auditor, installer, or system designer may be indicative of proficiency, but we have all known individuals, in many professions, who merely skate by, fooling customer after customer while achieving no real understanding and providing substandard performance and services. Conversely, being relatively new to the industry is not necessarily indicative of lack of proficiency.

After input from end users, utilities, energy efficiency organizations and other interested parties, recognizing this gap in the vetting chain, CAGI has developed personnel certification programs for professionals in the compressed air systems industry. These programs are based on existing resources and are designed to assess an individual's comprehension of topics germane to proper design, equipment selection, optimization, and/or assessment of compressed air systems. The programs are not training programs. Rather, their sole purpose is to evaluate an individual's comprehension through that individual's performance on an exam.

CAGI CCASS Program

The first program is the CAGI Certified Compressed Air System Specialist (CCASS) program, designed to provide a means of verifying the capabilities of professionals in the compressed air systems industry. The program will allow customers, utilities, employers and others to have confidence in the skills and abilities of the professionals in the industry who design, service, sell and install compressed air systems and compressed air systems equipment.

There are no pre-requisites to taking the CCASS exam; however, based on the material that is covered by the exam, it will be difficult for most individuals without some experience in the field to pass the exam. A full list of knowledge, skills and abilities that are covered by the exam and which successful candidates will possess can be found on the CAGI website on relevant pages accessed through the Training and Education/Personnel Certification options.

The body of knowledge, or the set of topics and resources that are covered by the exam and with which candidates should be familiar, is also available on the CAGI website on relevant pages accessed through the Training and Education/Personnel Certification options. For the CCASS program, all questions on the exam can be found in at least one of the following resources (the Body of Knowledge for the exam):

- CAGI Compressed Air and Gas Handbook
- DOE Compressed Air Sourcebook
- CAGI Website
- Compressed Air Challenge Website
- CAC Best Practices Manual
- CAGI Air Compressor Selection and Application 1/4 hp through 30 hp

Other good, recommended resources that will help an individual prepare for the exam include the following:

- CAGI E-learning Program
- CAC Level 1 Training
- CAC Level 2 Training

To become a CAGI Certified Compressed Air System Specialist:

- Register for the exam on the CAGI website, find a test center (located throughout the U.S.), and schedule an exam.

CAGI Personnel Certification: How to Have Your Own Personal Performance Verification Program

- Take the exam. This is a computer-based test. There are 80 multiple choice questions and examinees have 1.5 hours to complete the exam.

- Examinees will receive test results immediately. If you pass the exam, you will receive a certificate with a unique certification number as well as a certification seal to be used on business cards and correspondence.

The CCASS program is currently available, and CAGI is offering a discounted registration fee of $275.

CAGI CCASA Program

The second program is the CAGI Certified Compressed Air System Assessor (CCASA) program, designed to help identify pros who really understand how compressed air systems work. It assesses an individual's abilities and comprehension of advanced topics required for proper assessment of compressed air systems. The CCASA exam is available to any current Certified Compressed Air System Specialist. While the program is primarily aimed at system assessors, successful completion of the exam indicates mastery of advanced compressed air system topics, as well.

The Body of Knowledge for the CCASA exam includes the following, in addition to the resources for the CCASS exam:

- ANSI/ASME EA-4, Energy Assessment for Compressed Air Systems

- EA-4G, Guidance for ASME EA-4, Energy Assessment for Compressed Air Systems [ANSI Designation: ASME TR EA-4G]

- CAC Level 2 Training

The CCASA program is not yet available. All questions for the exam have been developed, and the committee of experts that oversees development and administration of the program conducted a final review of all the questions in March. CAGI staff is working with the third-party testing firm to launch a beta test of the program this year, sometime this summer. The beta test is used to verify the suitability of the questions and the exam overall for its intended purpose. All current Certified Compressed Air System Specialists will be invited to participate in this beta test. Those who successfully complete the beta exam will be the first class of CCASA certificants.

Once launched, the process for becoming certified as a CCASA will mirror the CCASS process.

For both CAGI exams, ongoing continuing education is required to maintain certification:

- Certification is active for three years. To maintain certification, certificants must obtain recertification units and apply for recertification.

- A list of activities that result in recertification units is included on the website.

CAGI has partnered with experts in design and administration of personnel certification programs to develop and make these programs available. These experts, known as psychometricians, provide guidance on proper formulation of the questions (known as "items" in psychometrician parlance) used in the exams. They also perform statistical analysis of the questions as they are used by prospective certificants in exam sessions. All questions and exams are evaluated on a regular basis to ensure they serve their intended purpose: differentiating qualified and unqualified individuals.

The CAGI Certification Path

The CAGI exams are neutral with respect to product, process and equipment or tools. Manufacturers and assessors have preferred assessment processes and equipment or tools that they use when addressing compressed air systems. The CAGI programs are not tailored to any specific assessment methodology or equipment that might be favored by one manufacturer or assessor versus another.

Why become certified? Why has CAGI undertaken the immense task of developing and maintaining a personnel certification program? Why spend the money, time, and effort? When the CCASS program was launched, then chair of the CAGI committee that develops and oversees the program, Wayne Perry, said, "CAGI believes the certification program will raise the credibility and confidence in the industry and help qualified individuals differentiate themselves as certified compressed air system professionals." The program is intended to help those who do possess the required knowledge, skills and abilities demonstrate their competence to end users, organizations that may be offering incentives, their peers and their current and future employers. The program is also intended to help end users identify and select qualified individuals. CAGI is helping the wheat separate itself from the chaff.

It is CAGI's intention that over time, certification will become a prerequisite to succeed in the compressed air systems industry. CAGI is actively working to make this happen. Selection and installation of equipment with verified performance in a system designed, assessed, and optimized by certified individuals who have been verified to possess the requisite knowledge, skills, and abilities is the end goal. Achieving this goal will ensure effective, efficient compressed air systems. Effective, efficient compressed air systems will lead to satisfied end users. Satisfied end users will ensure the long run viability of compressed air systems as a source of power and means of production. BP

About the Author

The CAGI System Assessment Section oversees the CAGI Personnel Certification Program and addresses topics related to performance and assessment of compressed air systems. The section comprises experienced individuals who represent CAGI members engaged in assessment activity.

About CAGI

CAGI is a non-profit trade association of manufacturers of compressed air system equipment. For more than 100 years, the institute has been the leading source on all matters related to compressed air. As the united voice of the industry, CAGI's activities include the development and organization of educational material about compressed air systems and equipment as well as training programs to benefit users of compressed air systems. In addition to information on data sheets, performance verification, and training, the CAGI website offers many resource materials such as selection guides, videos, and standards. For more information, visit www.cagi.org.

To read articles on ***Air Compressors,*** visit www.airbestpractices.com/technology/air-compressors.

For expert presentations, visit our Webinar Archive Section dedicated to ***Air Compressor Technology*** at www.airbestpractices.com/webinars.

SUBSCRIBER CORNER

"Crazy" Systems & Maintenance

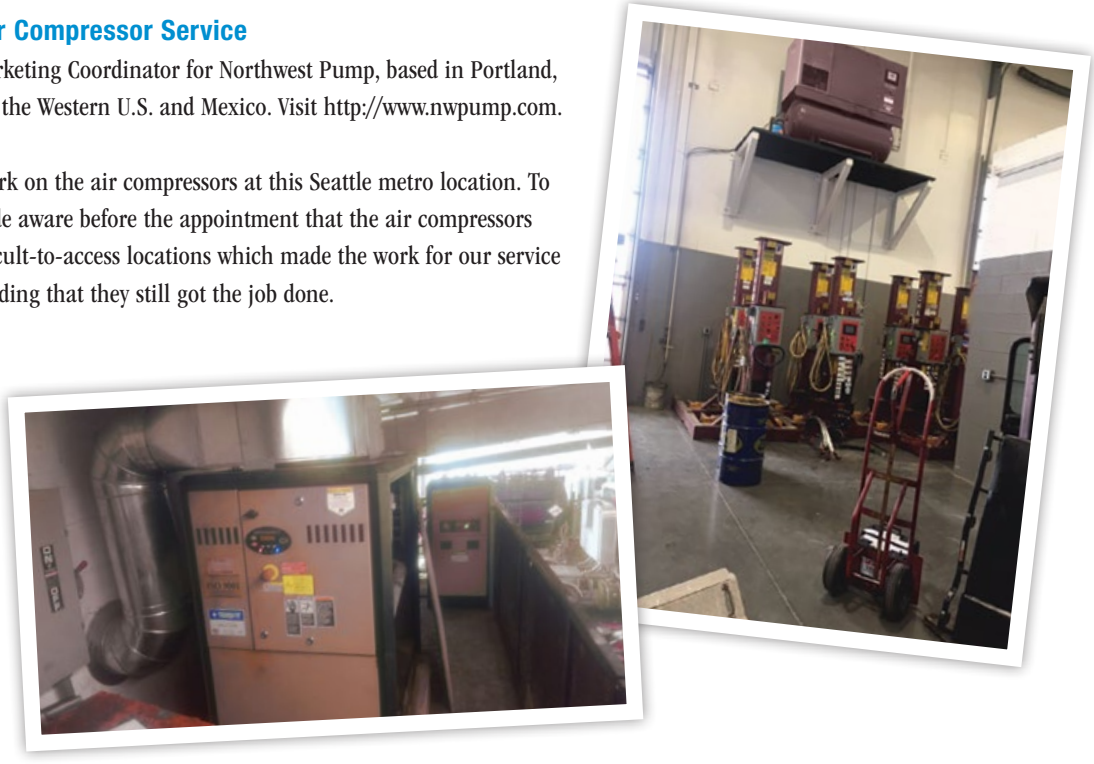
Edited by Troy Dreier, Senior Editor, Compressed Air Best Practices® Magazine

Manufacturing plants perform admirably under "crazy" profit expectations to remain viable. Plants often experience "crazy" staffing and operational budget reductions. Our editorial staff salutes our subscribers who keep on-site utilities up and running reliably every day, with fewer resources at hand. These subscribers requested we publish some observed "crazy" system designs and maintenance practices, present due to budget reductions in plants. Our goal is to raise awareness, providing a learning opportunity and encourage increased investments in staffing and systems.

Provide Easy Access for Air Compressor Service

Ruthie Carlo is the Industrial Marketing Coordinator for Northwest Pump, based in Portland, Oregon and with branches across the Western U.S. and Mexico. Visit http://www.nwpump.com.

"Our service techs went out to work on the air compressors at this Seattle metro location. To my knowledge, they were not made aware before the appointment that the air compressors were located in elevated and difficult-to-access locations which made the work for our service techs challenging," Carlo says, adding that they still got the job done.



No doubt floor space was tight for this Seattle metro manufacturer, but plan for easy access when installing a compressed air system.

Compressed air storage tank identification plates advise when the last safety inspection took place.

Compressed Air Storage Tank Inspections Are Vital

Eduardo Lopez is a mechanical engineer with Baja Design Engineering in Mexicali, Mexico. Visit https://bdefp.com/.

"At this plant in Mexico, the maintenance department does not supervise the maintenance of compressed air receiver tanks. The department must paint some things, among them the compressed air storage tanks. Why are they painted? Because they are dirty or have corrosion. I know, it shouldn't be done that way, but the reality is that that's how they do it. The corrosion is not cleaned or chemically treated; it is simply painted over. Here is one example. After painting a corroded tank we see that the paint is already lifting again. Furthermore, whoever did the painting covered the tank's identification plate. Someone had to remove the paint so it could be read."

Pressure vessels, such as receiver tanks, need to be safety recertified by regional certifying bodies on a regular basis. Over time, the integrity of tanks can suffer, so recertification is crucial.

Filter Element Maintenance Is Key to Compressed Air Quality

Albert Williams is a freelance energy auditor and energy engineering training instructor based in South Africa. Visit https://www.linkedin.com/in/albertedwardwilliams/.

Occasionally, an operator gets fed up with the pressure loss across a clogged filter and decides to permanently open the bypass valve, Williams notes.

"This picture was taken in an appliance manufacturing plant in South Africa. It was in the main air compressor room before the primary receiver, and before feeding into the main ring. During my audits spanning a few weeks, the filter bypass line stayed open."

Bypass piping is recommended so plants can maintain system pressure when changing their filters. Filter elements should be regularly maintained and the bypass valve closed so proper compressed air filtration is achieved.

Bypass valves should only be opened to permit the timely replacement of filter elements.

Submission Guidelines

We invite our subscribers to send their observed "Crazy" Systems & Maintenance experiences to Troy Dreier at troy@airbestpractices.com. Please send a high-resolution picture as a JPG or GIF file and a note describing the installation, what was wrong and what the solution should be. We will edit the text and remove equipment brand names and references from all materials. If we publish your submission, we'll thank you with a $25 Amazon gift card.

SUBSCRIBER CORNER

Readers From Around the World

We salute all Best Practices Magazine Subscribers from around the world who own, operate, maintain, engineer and provide expertise for the on-site utilities (compressed air, nitrogen generation, vacuum, blowers, chillers, cooling towers, pumps) powering modern plant automation. This subscriber-driven monthly column hopes to build community and recognize all subscribers!

At Tunna Industrial in San Luis Potosí, Mexico, compressed air is the family business. This third generation family-owned company was founded in 1979 and recently celebrated its 45th anniversary. Tunna provides products and services for breathing and medical compressed air system, nitrogen, vacuum and cooling water systems. It also provides analysis to improve operator efficiency. It's currently run by the brother-sister team of Manuel Ramón Elizalde Martinez (managing general) and Mella Elizalde (CFO). Other family members on staff include Manuel's sister Magdalena Elizalde (sales director) and daughter Montserrat Elizalde (administration and finances). Visit https://tunna.com.mx/

John Bilsky knows the best way to read "Compressed Air Best Practices" is two at a time! John is a Facilities Specialist for Gentex Corporation in Zeeland, Michigan, where he puts his wide-ranging knowledge to use designing, improving and maintaining compressed air, water purification and nitrogen generation systems. Gentex specializes in highly automated electronics, CMOS camera development and manufacturing, vacuum coatings and glass bending and fabrication for customers in the automotive, aerospace and fire protection industries. Visit https://www.gentex.com/

Submission Guidelines

We invite our subscribers to send in pictures so we can see the people who read our Best Practices magazines! Those holding a recent magazine issue will receive first consideration. Please send a high-resolution picture as a JPG or PDF file and a note describing the team and company to Troy Dreier at troy@airbestpractices.com. If we publish your submission, we'll thank you with a $25 Amazon gift card.

BEST PRACTICES

EXPO & CONFERENCE CABPEXPO.COM

COMPRESSED AIR / VACUUM / COOLING

The Largest North American Event for On-Site Utilities!

Registration Now Open for Best Practices 2024 EXPO & Conference

The Best Practices EXPO & Conference brings leading experts and users together of **On-Site Utilities (Compressed Air, Pneumatics, Vacuum, Blower, Nitrogen Generation, Chillers and Cooling Towers).** They will share "Best Practices" for positive impacts on Sustainability, Safety and Reliability manufacturing metrics.

Sustainable, Safe & Reliable **ON-SITE UTILITIES** Powering Automation

Sustainable
Energy/Water
Conservation Projects

Safe
Product Quality/Safety
System Compliance

Reliable
Uptime and
Scrap Reduction

JOIN US IN ATLANTA /// OCTOBER 29-31, 2024

REGISTER TODAY!
CABPEXPO.COM

SPONSORED BY

CAGI Compressed Air & Gas Institute

CTI COOLING TECHNOLOGY INSTITUTE

Four Compressed Air Demand Reduction Projects

By Don Van Ormer, Senior Auditor, APenergy

A large food manufacturing operation in the U.S. Midwest spends $529,000 annually on energy to operate the compressed air system.

The plant currently has two supply-side systems that operate and feed two different distribution networks at two different pressures. One compressed air system is at 115 psig (medium pressure system) and the low-pressure system is at 30 psig. The compressed air equipment for both systems is located in four areas throughout the facility.

The medium-pressure system has four air-cooled, two-stage, oil- free, rotary screw air compressors. Two air compressors have integrated rotary drum dryers and the other two have external, air-cooled, refrigerated dryers. There is also a single air-cooled, lubricated, rotary screw air compressor. This system supplies the needed compressed air to operate the plant's production equipment and is located in three different areas.

The low-pressure system has five oil-free, air-cooled, rotary screw air compressors. Three of the air compressors are 125 psig, two-stage units. These units produce 115 psig compressed air which is then regulated down to around 30 psig. The other two are single-stage, oil-free, air-cooled, rotary screw air compressors producing compressed air at 30 psig. One unit has an internal, rotary, heat-of-compression dryer, two have external refrigerated dryers, and one has a water-cooled heat exchanger with a desiccant dryer supplying compressed air to an external building.

Prior to our audit, the plant decided to create a low-pressure compressed air utility room. It purchased two oil-free, 30 psig, centrifugal air compressors and moved the 125 psig units to the medium pressure system. The low-pressure system is for the process of aerating and stirring the ingredient batches in the storage tanks until ready for bottling.

Our firm was invited to examine the demand-side of the compressed air system. We focused on the piping systems and on ways to reduce demand. Due to article space limitations, this audit excerpt focuses on the demand-side reductions identified.

All projected savings in this audit reflect an air compressor control system able to translate demand reduction into energy savings. The system operates 8,400 hours per year and the local electric rate was $0.08 per kWh.

Summary of Demand Reduction Projects

Project	Flow Savings scfm	Power Savings kW	Energy Savings kWh/yr	Annual Savings $	Estimated Project Cost $
Repair 87 identified and tagged compressed air leaks	287 scfm	58.0	487,463	$39,000	$19,000
Install dew point demand control on heatless desiccant dryer	46 scfm	9.3	78,130	$6,250	$5,000
Replace open blows with air saver nozzles and/or auto shut-off controls	127 scfm	25.7	215,707	$17,260	$5,000
Install automatic no-air-loss condensate drains	3 scfm	0.6	5,095	$410	$1,200
TOTAL	**463 scfm**	**93.6 kW**	**786,395 kWh/yr**	**$62,920**	**$30,200**

No.	Location	Description	Pressure at Leak (psig)	Decibel Reading from 6" away (Db)	Calculated Leak Size scfm
1	Palletizer	3/8" Female NPT	50	61	3.2
2	Filler Bottle Line	¼" PPFX Ppt Straight to Solenoid Bank	50	79	4.9
3	Labeler	Regulator Gasket Bad 3/8" In/Out	50	63	3.4

*All 87 tagged leaks were given this level of description in the above table format to maintenance for repair to be schedule.

Project #1: Compressed Air Leak Survey

A compressed air leak survey was conducted for the plant and 87 leaks were identified, quantified, tagged, and logged. Potential savings totaled 287 scfm for the tagged leaks.

Most of the leaks could not have been found without the use of an ultrasonic leak detector and a trained operator. Leak locating during production time with the proper equipment is effective and often shows leaks that are not there when idle. However, a regular program of inspecting the systems during off-production hours with air powered up is also a good idea. In a system such as this one, some 80% to 90% of the total leaks will be in the use of the machinery, not in the distribution system Most plants can benefit from an ongoing air leak management program. We recommended that this plant purchase an ultrasonic leak detector and implement a program with maintenance personnel.

Number of leaks tagged and identified	87 leaks
Air reduction	287 scfm/yr
Annual electric cost savings	$39,000/year
Unit cost of leak repairs ($150 materials per leak and $70 labor per leak)	$220
Overall cost of leak repairs	$19,140

Project #2: Install Dew Point Demand Control on Heatless Desiccant Dryer

One of the four areas has a heatless (pressure-swing) desiccant air dryer providing a -40° F pressure dew point. This dryer has a maximum rated flow capacity of 636 scfm. The dryer does not have a purge economizer and is purging the standard 15% of the compressed air to regenerate each tower.

This project involves installing a purge economizer on the unit. We anticipate this project will deliver 46 scfm in savings by reducing the purge rate to 7%.

Current dryer purge air rate	15%
Current dryer rated capacity	636 scfm
Dewpoint demand control savings	7%
Project flow reduction	46 scfm
Annual energy savings	$6,250/year
Estimated project cost	$5,000

Four Compressed Air Demand Reduction Projects

Project #3: Open Blows

Open blows are devices in which turbulent compressed air blasts straight out of a pipe or tube. This process not only wastes huge amounts of compressed air, but also violates OSHA noise and dead-ended pressure requirements.

Air jets and air flow-inducing nozzles used in place of open blows can reduce noise level, lower compressed air use, and most often

Open Blow Applications									
Location	Qty	Type / Size	Estimated Current CFM Usage Each	Utilization	Net Avg Cfm	Recommended Action / Nozzle	New Avg Net CFM Each	Net Avg CFM Usage	Est Net Avg Cfm Saved
Bucket Feed Clean	1	3/8" Fitting	30	36%	10.8	48008	7	2.52	8.3
Line 3 Filler Dry	3	Wind Jet	25	40%	30	48008	7	8.4	21.6
1/2 Gallon Filler	6	Wind Jet	25	40%	60	48008	7	16.8	43.2
1/2 Gallon Filler	6	Silvent	15	40%	36	48008	7	16.8	19.2
1/2 Gallon Filler	1	2" Venturi	30	40%	12	48008	7	2.8	9.2
Line 1 Labeler	2	Lechler	5	70%	7	48002	1.8	2.52	4.5
Line 2 Labeler	1	Lechler	5	70%	3.5	48002	1.8	1.26	2.2
Line 1 Cap Seal	1	1/4" Poly	10	70%	7	48002	1.8	1.26	5.7
Line 2 Filler	4	Lechler	15	40%	24	48008	7	11.2	12.8
Totals	**25**				**190.3**		**Total**		**126.7**

improve blow-off operation in both productivity and quality.

We recommend the use of engineered air nozzles for the open blow applications listed in the table.

Number of open blows to be replaced	25
Project flow reduction	127 cfm/yr
Annual energy cost savings	$17,260/yr
Estimated project cost (25 blows x $200/blow)	$5,000

Project #4: Install Automatic No-Air-Loss Condensate Drains

All (but one) identified condensate drains were automatic, no-air-loss condensate drains. These are high quality drains with an internal capacitance tube inside. The only moving part is the drain solenoid.

The exception was one refrigerated dryer that came with a dual-timer electronic drain. This drain should be replaced with a no-air-loss drain.

Dual-timer electronic drains use an electronic timer to control the number of times per hour they open and the duration. In theory, the frequency should be adjusted to ensure that condensate drains open fully and that the open time without water is minimized because compressed air is wasted. But cycles often are not reset from original factory settings, resulting in condensate build-up during the summer and being set wide open during cooler weather. When they fail in "open position," they blow at a full flow rate of about 100 scfm.

Air flow (cfm) savings per drain (each)	3 cfm/yr
Total of number of drains	1
Total compressed air saved	3 scfm
Total annual energy savings	$410/yr
Cost of project ($700 materials and $500 installation)	$1,200

Conclusion

Manufacturing plants have consistent opportunities to reduce compressed air demand. The projects we repeat at most plants include compressed air leak surveys, heatless desiccant dryer purge economizers, open blows and automatic no-air-loss condensate drains. BP

For more information on APenergy visit apenergy.com or call 740.862.4112.

To read similar ***Compressed Air System Assessment*** articles, visit https://www.airbestpractices.com/system-assessments.

For expert presentations, visit our Webinar Archive Section dedicated to ***Air Compressor Technology*** at https://www.airbestpractices.com/magazine/webinars.

Holistic Controls for Superior Cooling Systems Efficiency, Part 2

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

NOTE: This is the second of a two-part article on the critical requirement for holistic system controls to achieve the highest cooling system efficiencies. Part 1, printed in the January/February 2024 issue of Compressed Air Best Practices, laid the groundwork for this discussion by describing widely found control designs and operations, as well as common weaknesses in those applications. Readers are encouraged to review that portion before reading Part 2, as the information presented here presumes familiarity with the definitions and general application concepts presented in Part 1. Building on that introduction, this article will describe integrated "holistic" controls and present representative applications showing how they result in superior cooling system efficiency.

Part 1 of this article described three factors of process cooling system efficiency (equipment selection, system implementation and system operation) and all three must be in optimal condition to have the highest efficiency. System operation was also noted to be a combination of both the system controls functions (or lack thereof) and plant operating practices.

Cooling system efficiency can be a significant competitive advantage for organizations that seize the opportunity.

Many forums address the first two components of the high-efficiency triad. Product manufacturers frequently tout the increased efficiency of their latest products and engineering design articles regularly discuss the benefits of various system design features, including several by this author in previous editions of this same publication.

Furthermore, the third aspect of efficiency, system operation, is periodically recognized as important in its own right, and various presentations are made that cover different facets of controlling and operating systems. However, while this third component is not ignored, it is fair to say that system operation, and in particular the controls functions

portion, is not set apart for the truly decisive impact it has on system efficiency.

The Criticality of Controls

The importance of the controls' performance to overall system efficiency cannot be overstated. In fact, outstanding controls can wring higher efficiency out of an average system (hardware and design) than a highly efficient system can achieve with poor controls. This may be difficult to accept, but there are good explanations for why this is true.

First, after years of efficiency awareness, the difference between standard and high efficiency equipment is often modest (perhaps 5 – 10%); similarly, system design differences may be responsible for another 5 – 15% efficiency improvement. As stated in the previous article, high performance controls and operating strategies can deliver 35 – 50% efficiency savings with the same equipment and system design (more explanation of this later).

Second, as cooling conditions are inescapably variable over time, the control operation of the equipment is the critical factor in system efficiency. Most plants have varying cooling loads as lines are started and stopped, molds changed, PMs performed, etc. and these result in variable loading on the cooling system. Even in cases with atypically flat loads (such as data centers), cooling systems as a whole exist in dynamic ambient environments; consequently, significant opportunities exist to exploit the off-design conditions present the majority of yearly hours.

Finally, cooling systems with high performing controls strongly correlate with recognized best practices operation of the plant. The controls capability enables and supports the operators in managing the cooling system proactively so equipment is maintained (filters are cleaned, bearings are lubricated), equipment that is due for scheduled maintenance or needs repair gets handled promptly to again be available for operation and opportunities to improve the operation can be identified and qualified through the system data display and trend data analysis.

In situations where all the high-efficiency elements are present, the overall improvement in efficiency can exceed 50% of the base system operating efficiency. Note that this is specifically referring to industrial process cooling systems, not commercial building HVAC systems – while the same techniques and concepts apply, commercial systems' loading is nearly always closely tied to weather conditions and therefore they are not as able to capitalize on the off-season ambient conditions existing for year-round industrial applications.

Holistic Systems Controls

The previous article presented the concept of system controls that span the complete cooling system. To recap, this means a single or consolidated control platform that controls the entire cooling system including the various interconnected sub-systems, including chillers, pumps, cooling towers, and free cooling heat exchangers. Comprehensive system controls also provide HMI functions including status displays, fault alarms and data trending and reporting. Altogether, system controls should

Pump and Fan Affinity Laws Power Calculations

Propeller type fans and centrifugal pumps in closed loop systems generally follow a set of equations for their speed, flow, pressure and power as long as they stay in an applicable range and system configuration. These equations, known as the Affinity Laws, apply to changes in speed and fan or pump impeller diameter, however we will only address the speed implications here since our scenarios are based around using VFDs for speed changes and not for impeller diameter modification (typically trimming).

The equations are:

$$\text{Speed1} \propto \text{Flow1}$$

$$\text{Speed2} \propto \text{Flow2}$$

$$(\text{Flow2} / \text{Flow1})^2 = (\text{Pressure2} / \text{Pressure1})$$

$$(\text{Flow2} / \text{Flow1})^3 = (\text{Power2} / \text{Power1})$$

When applied to a modest speed reduction for a pump from 100% to 90% we get these results:

$$(0.90 / 1.00)^3 = (\text{Power2} / \text{Power1})$$

Solving for Power2, we get

$$\text{Power2} = 0.729 \times \text{Power1} = 72.9\%$$

or roughly 73% of the initial power requirement. Assuming around 3% losses in the VFD, the 10% speed reduction saves approximately 25% of the initial power; obviously greater speed reductions would generate even more savings.

In cases with pumps where there are partially closed system valves either for pump motor amp limitation and/or loop flow settings, use of VFDs would save even more along with the separately mentioned benefits of improving the motor and driven load operating conditions (such as lower temperatures, lower bearing and coupling loads or lower seal pressures).

Holistic Controls for Superior Cooling Systems Efficiency, Part 2

reduce operator workloads and support potential efficiency improvements.

The earlier article also introduced the term "holistic" system controls which are high performance system controls that constructively integrate the interaction effects of the linked sub-systems. It cannot be emphasized enough that simply having system controls does not mean they function holistically.

To further clarify the scope of holistic controls, they include both the programmable controls and functional logic to control the equipment operation as well as the VFDs, sensor inputs and other physical interfaces to effect the operations. Practically speaking, every motor load in a holistically controlled system should be on a drive to support the control functions and provide other benefits of drive operation[1], and this continuing discussion assumes drive control capabilities on all relevant applications.

The previous article also observed that the complexity of the linkage between sub-systems was both the challenge to higher efficiency and the source of the efficiency improvement opportunity.

Holistic controls purposefully manage the operation of the cooling sub-systems to aggressively extract savings from the various components. This means holistic controls frequently trade sub-system energy use between different portions of an overall cooling system to get the highest total efficiency. Critically, this must be done with due care to ensure the efficiency improvements don't come at the expense of effective process cooling – we can't have the tail wagging the dog!

While this sub-system leverage may occasionally happen in standard system controls, for example when cooling tower setpoints are lowered for better chiller efficiency, holistic systems will closely manage conditions and equipment to achieve notably higher efficiency. In the cooling tower setpoint example, holistic systems might also use the following functions:

- Tower setpoint lower than the chiller manufacturer's normal minimum recommendation when possible but floated up to the tower design temperature when required by outdoor conditions
- Condenser pump flow control based on chiller refrigerant differential pressure
- Centrifugal chiller inlet guide vane position monitoring to trim the degree of tower setpoint adjustment[2]

By combining these three control functions, the tower fan runs only as needed in warmer outside conditions, and the condenser pumping and chiller energy are optimized with minor increases in tower fan energy when it's cooler outside. Overall annual tower fan energy is saved by not running to an unattainable setpoint in summer even with the modest increases in the cooler months. The condenser pumping power may be reduced by 25 – 40% or more while the chiller energy use is either the same or trimmed modestly, *and this is on top of the basic chiller energy savings from a lower condenser water temperature.*

To highlight the insignificance of the cool season tower fan energy changes, consider that for running a fan at 30% speed vs. 20% speed (a typical premium for lower leaving water temperature in cool conditions), the incremental fan power is just under 2% of the full speed fan power – and this on what is typically the smallest portion of the

overall system power. The calculations are illustrated below.

Fan power at 30% speed as fraction of full speed power (see sidebar on the fan and centrifugal pump affinity laws if these are unfamiliar):

$$(\text{Speed2} / \text{Speed1})^3 = (\text{Power2} / \text{Power1})$$

or in this case:

$$(0.30 / 1.00)^3 = (\text{Power2} / \text{Power1})$$

Solving for Power2, we get

$$\text{Power2} = 0.027 \times \text{Power1} = 2.7\%$$

Similarly, the power for 20% speed is

$$(0.20 / 1.00)^3 = (\text{Power2} / \text{Power1})$$

Solving for Power2, we get

$$\text{Power2} = 0.008 \times \text{Power1} = 0.8\%$$

As a result, the power penalty to run the fan at 30% instead of 20% is

$$2.7\% - 0.8\% = 1.9\%$$

For a typical system where the fan power is typically under 10% of the total HP, this would represent around 0.2% of the nominal full power requirement.

Standard System Controls vs. Holistic System Controls Functional Comparisons

Table 1 lists typical cooling sub-systems and the control functions applied in standard and holistic control systems. Note these are broadly representative of common industrial systems but there are many variations and functions not listed in this article.

Beyond the general concepts listed in the table, there are numerous implementation details that characterize fully functional systems such as non-overlapping centrifugal separator blowdown schedules, water metering for usage monitoring and fault conditions and automatic pressure sensor blowdown control. Unsurprisingly, these are tailored to specific system requirements.

Systems Controls Offset of Design Limitations

As stated earlier in the section on the critical importance of the controls to total system efficiency, high performance controls can adapt for less than ideal system design, and it's in these functional differences that the adaptation takes place. For example, an extremely common standard system design and controls feature is constant speed pumping to tower and chiller recirculation loops (this occurs often even in systems with variable pumping to the process cooling loads).

To rectify these situations, high performance controls will include logic that in some way ties the recirculation loop flow to the process loop flows. There are multiple approaches that can be used depending on the specifics, such as using a fixed speed ratio for the recirc pumps to the process pumps or linking the loop delta-Ts, but whatever method is used will reduce the recirc loop pumping.

Even a modest 10% reduction from full speed will save around 25% of the pumping power (see the Affinity Laws sidebar) and potentially more if there are partially closed valves on the recirc pump loops (a common occurrence at pump discharges and other loop locations). Moreover, the power savings reduces the motor heating, bearing and coupling loads and seal pressures, all of which extend the life of the pumps and lower the maintenance requirements.

These benefits substantially offset the efficiency penalty in the suboptimal design at modest cost and without requiring significant reworking of the piping or other major changes. Note that a better initial system design would yield still better efficiency and would have cost less

Table 1 – Typical Cooling Sub-Systems And The Control Functions Applied In Standard And Holistic Control Systems

Sub-system	STANDARD SYSTEMS	HOLISTIC SYSTEMS
Tower Fan(s)	Single setpoint	Setpoint float on ambient conditions
Condenser Pumps/Open Tower Water Pumps	On/off operation	Speed varied in relation to water temperature
Chiller Recirc or Primary CHW Pumps	On/off operation	Speed varied in relation to water temperature and/or total process cooling loop flow functions
Process CHW or Secondary CHW Pumps	On/off operation, or pressure in mechanical room controlling pump speed	Speed varied based on one or more remote differential pressure sensors (as needed by system design)
Chillers	Staged on & off on chiller amp loading %	Staged on load % with part-load considerations and delta-T mgt. for higher efficiency loading
Process/Machine Open Loop (Tower) Cooling Pumps	On/off operation	Speed varied based on closed loop temperature with temperature setpoint varied in relation to tower water temperature
Process/Machine Closed Loop Cooling Pumps	On/off operation	Speed varied based on one or more remote differential pressure sensors with pressure setpoint varied in relation to water temperature
Sensor Suite	Minimal points needed for operation	Enhanced point list for system operation characterization and control point redundancy

Holistic Controls for Superior Cooling Systems Efficiency, Part 2

Table 2 – Comparative Examples		
APPLICATION: Cooling Tower Fan Control	**IMPLEMENTATION**	**RESULTS**
Standard System Controls	Single temp sensor, remote from discharge (installed where convenient, such as in a tank or pipe inside a building)	Long response delays due to flow lag and blending effects, extreme hi-lo fan cycling, ±5° temp swings
Holistic System Controls	Individual cell temp sensors in immediate discharge pipes from tower cells	Much closer control <±1°, individual cell response for better loading[3]
APPLICATION: Chilled Water Pump Control	**IMPLEMENTATION**	**RESULTS**
Standard System Controls	On/off (no pressure) control only or single pressure/DP near pumps	Pressure deviation of ±10% to 30% based on lines running and pump mix
Holistic System Controls	Differential pressure sensed in midst of loads, multiple points if needed	Greatly improved pressure stability to lines, typically less than ± 5% total
APPLICATION: Free Cooling Transition Ctrl	**IMPLEMENTATION**	**RESULTS**
Standard System Controls	Typical commercial system transition – stop chillers, lower tower water temp, change valves to FC HX	No net cooling to process during cooldown or warm-up transition back to chillers, cooling water temp rise of 5 - 15°, variable duration spike
Holistic System Controls	Chillers kept on through tower water cooldown, FC HX pre-cooled, transition completes once temp reached using proportional control valves for change	Continuous process cooling through transition, temp swing usually < 2°, process flow consistent during transition due to pressure control of pumps

to install to begin with, but at least all is not lost if intelligent controls are implemented as described.

Holistic Systems Controls Implementation Distinctions

In addition to the simple "yes or no" questions on the presence of various advanced control functions, Holistic controls also include concentrated focus on the how of the implementation, and correctly doing the how requires knowledgeable and focused implementation personnel.

As noted, the majority of cooling systems, and thus the experience base of most control engineers and technicians, are commercial HVAC systems. Industrial process cooling is different in key use aspects from commercial systems, most critically in the regular presence of meaningful load changes – process cooling loads often change in significant steps (such as when lines start and stop) vs. the general daily rise and fall characterizing many commercial air conditioning loads – and close control must be maintained over the cooling process during these changes. Commercially grounded personnel are frequently not attuned to the demanding requirements of process cooling and will unknowingly employ unsuitable control approaches in industrial systems.

To the contrary, the capabilities provided by dedicated industrial controls specialists through holistic controls should actually improve the process cooling effectiveness by making the cooling more uniform, even while efficiency improves. Consider the following comparative examples in Table 2.

Like these examples, many typical commercial applications approaches have poor efficiency, poor stability, or both in industrial use. As cooling for process operations, uniformity of the cooling is (or at least, should be) paramount in the cooling system operation; and operating efficiency should be as good as it can while still meeting the production requirements. Producing 10,000 plastic forks with the tines pointing inward due to cooling water temperature spikes is not acceptable!

As illustrated in the examples, a key focus with holistic controls is locating the sensors where they most accurately indicate the system conditions, which then enable the controls to more effectively manage the operation. The common practice with many system installers is to place sensors where convenient and only install the minimum points necessary for the control methods used, and while these are functional at a base level, they do not support optimal system performance.

Unfortunately, poorly implemented systems are common. One frequent condition with standard system controls (along with the No Controls and Standalone Controls systems) is maintaining somewhat uniform cooling by excessive equipment operation – having more pumps running than needed much of the time, for example, with the result that equipment is run harder and longer than otherwise needed and hence requiring more maintenance and more frequent replacement. What is often counterintuitive about holistic controls is that the enhanced performance not only meets the process uniformity requirements, it also provides the highest possible efficiency and related maintenance and equipment life savings.

Typical standalone control system with on-skid pressure sensing and pump VFDs.

Assessing Incumbent Controls Systems

So how does a system owner or operator determine if they have holistic system controls? In part this can be determined by just looking, but it then gets more complicated as appearances alone don't tell the whole story.

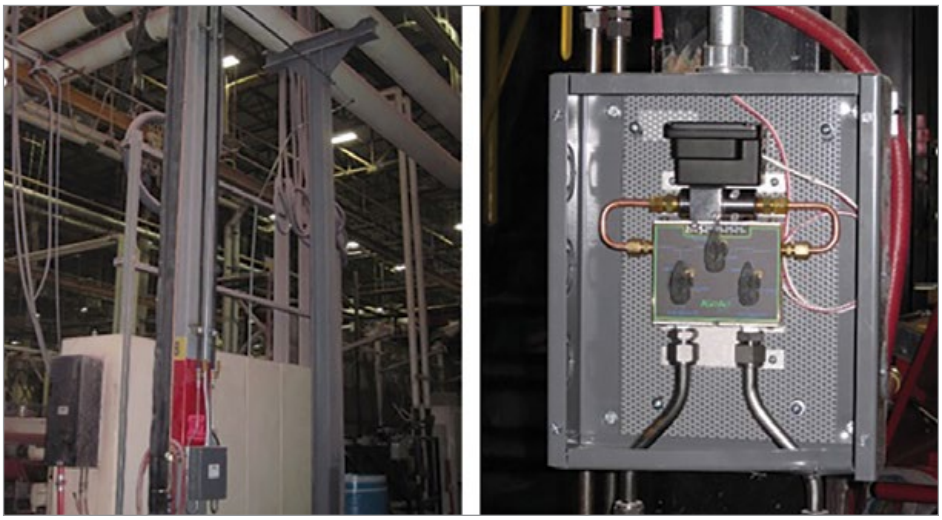
In our framework of controls categories – No Controls, Standalone Controls and Standard System Controls – the first two can be somewhat determined visually. Recall that No Controls is either literally no system controls, just On/Off switches or their equivalent, or single device unit controls such as on an air-cooled chiller that are integral to the device; in other words there are no controls applied to the equipment externally. Standalone Controls refers to external and frequently multi-device controls that are dedicated to a single function (e.g. cooling tower fan control) or functional group (such as a pressure controller on a pump skid with on-board controller and pump VFDs).

These system types by definition are not system controls, and if there are no overall controls – no main HMI interface, no controller(s) performing equipment control of essentially all the cooling system components – then there are no system controls and certainly no holistic system controls.

If a plant does have System Controls as defined in this context, determining if they are Standard system controls or Holistic controls is necessary to consider the potential for improvements.

Self-Assessment Questions

To rephrase the comparison of standard system controls and holistic systems, both system types have control over more or less the entire cooling system; consequently, the distinction is one of functional depth versus span of coverage. If a cooling system has system controls, the following are conditions to look for and review with your system operators and/or vendor technical support to assist in determining whether the potential exists for more effective controls:



Remote differential pressure sensor installation

Holistic Controls for Superior Cooling Systems Efficiency, Part 2

Which control system is holistic? Can you tell by appearances? It's the one on the right but there's no obvious distinction from just looking.

- When it's cool outside, do tower water temperatures regularly cycle from higher to lower values?
- When it's warm outside, do tower fans run continuously while the tower water temperature floats up a few degrees through the day and down over night?
- Are there VFDs on pumps that run in hand and/or that run under control constantly at or near full speed (55-60 Hz output frequency)?
- Are there VFDs that regularly oscillate between higher and lower frequencies, for example 48 Hz and 42 Hz up and down every 5-10 seconds continuously?
- Are there pumps and flow loops that run constantly and continuously regardless of variations in cooling load (such as the number of lines running or daily throughput)?
- Do multiple chillers routinely run at low loads or, conversely, high loads with CHW temperatures floating above desired setpoints?

These same questions can be used to evaluate potential cooling control systems for new projects by rephrasing them as functions that should be present in a new system and as performance standards against which an operating system will be reviewed. If a vendor is uncertain about the concepts or unfamiliar with methods to install these functions, then perhaps they aren't the folks you should be working with.

Conclusion

Cooling system controls are a decisive part of realizing high system efficiency. This article through two parts has presented basic types of cooling system control, the relationship of the control types to typical system efficiencies, and the importance of having knowledgeable industrial controls vendors. Further, this second part has explored the distinction between standard system controls and holistic controls for highly efficient process cooling systems. Examples of high performance controls features and implementations have been provided, and screening questions are listed for initial investigation of existing system and potential new systems.

Optimal system controls may cut the energy use of a system by 35 – 50%.

Hopefully this material helps readers evaluate their cooling controls and to develop projects to improve their system operations and efficiency. Please contact the author with any questions or comments. BP

For questions or more information about Integrated Services Group visit www.isg-energy.com or email: info@isg-energy.com.

Endnotes

1 This is for both control purposes but also other benefits of drive operation. Exceptions would be made for small motors that only run intermittently such as sump pumps, basin sweeper pumps, etc.

2 Beyond a certain point, further condenser water temperature depression just causes more guide vane closure which offsets the benefits of the cooler condenser water.

3 Note that in cases where the entering tower water temperature changes to abruptly, a forecast function can added to the leaving water temperature control logic that enables the control PID to anticipate the temperature rise and maintain tighter leaving water temperature control.

For similar articles on ***Cooling Controls System Assessments*** please visit coolingbestpractices.com/system-assessments/cooling-controls.

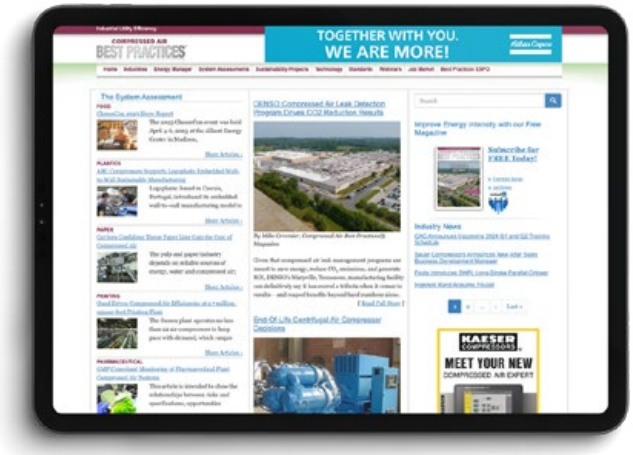
Visit our Webinar Archives to listen to expert presentations on ***Cooling Technology*** at coolingbestpractices.com/magazine/webinars.

COMPRESSED AIR
BEST PRACTICES
airbestpractices.com

Sustainable, Safe & Reliable
ON-SITE UTILITIES
Powering Automation

FREE SUBSCRIPTION

DIGITAL EDITION FREE WORLDWIDE | PRINT EDITION FREE TO U.S. SUBSCRIBERS



2024 FOCUS INDUSTRIES!

Compressed Air Leak Elimination • Dairy/Cheese Processing • Food Safety • Measurement
Plastic Food & Bev Packaging • Compressed Air Energy Conservation • Nitrogen Generation
Reliability • Sustainable Manufacturing • Safe & Reliable Manufacturing • On-Site Utilities

The Magazine for Sustainable, Safe and Reliable Compressed Air Systems

Compressed Air Best Practices® is part of a family of magazines dedicated to **Sustainable, Safe and Reliable On-Site Utilities Powering Automation.** The U.S. Department of Energy estimates compressed air represents 30% of industrial energy use. Each issue features expert articles on how to conduct **Best Practice System Assessments** to reduce energy consumption while enhancing **Sustainability, Safety and Reliability.**

"We design around a specific number of plastic product production machines….we have the correct compressed air flows with clean air and stable pressure."

— Leandro Sponchiado, Technical Director USA, Logoplaste (April 2023 Issue)

"The cast for our airends is so durable that we can now use some of our learning to make older airends more efficient as remanufactured airends."

— John Randall, President & CEO, Hitachi Global Air Power (July 2023 Issue)

Subscribe Now!

To subscribe visit **airbestpractices.com**

Festo's Smart Proximity Switch Commissions Itself

By David Gersovitz, Freelance Business Writer

There are indeed rewards for machine builders who sweat the small stuff. The latest iterations of many tiny but essential components like sensors, cameras and switches can pack a great deal of innovation for their diminutive size.

For Pro-Line Automation Systems of Woodbridge, ON, adopting Festo's SDBT-MSX – the world's first proximity switch with auto teach-in – eliminated a small but previously necessary step for achieving final operational readiness of its highly advanced, automated CNC fabrication systems for window and door manufacturing. The SDBT-MSX's auto teach-in feature automatically learns and sets the correct final switching point when the machine is turned on the first time, unlike legacy proximity switches which need follow-up, manual tuning after commissioning. With many proximity switches on each Pro-Line machine, the time savings from no longer having to make this follow-up adjustment really add up.

Pro-Line is extremely busy, as are its customers across North America, facing strong demand as the continent ramps up efforts to launch more residential construction. Single family, multi-unit and high-rises all have windows made by Pro-Line customers using its machines. The company has seen its sales almost double over the past five years, says owner Vinode Ramnauth, and it's embarking on a U.S. expansion with the potential to double sales again over the next two years. The company is an eager early adopter of new technologies that make its staff more efficient. It's already the biggest user of the SDBT-MSX in North America for that reason.

This feature-rich proximity switch is one example of the advances Festo is making in designing next-generation components, large or small. Besides incorporating performance enhancements, it makes simplifying installation, commissioning, and configuration points of emphasis.

Proximity switches are affixed to pneumatic actuators to signal the PLC or controller that the full extension of the piston has been reached. They are invariably one of the least expensive functioning components on a bill of materials.

The SDBT-MSX is the most advanced in its class of magnetic proximity switches. It's about the size of a baby's pinky finger. You probably wouldn't notice it on a machine unless you looked for it.

First and foremost, what makes it special is the auto teach-in feature. When setting up a legacy proximity switch, a technician generally locates the actuator in the machine prior to commissioning, affixes the switch in the T slot or bracket of the actuator at the approximate end position of the extended piston. Since commissioning that legacy switch requires a power supply, it's generally done when the machine is turned on for the first time, which usually does not happen under full compressed air load. When the machine is eventually turned on under full load, each such switch must be fine-tuned. That adjustment usually takes just a couple of minutes per switch but

The diminutive Festo SDBT-MSX proximity switch, shown here affixed at the top of a round ISO cylinder, is the world's first such sensor with auto-teach-in, for simple, fast one-and-done commissioning.

multiplied by the number of switches on a machine, often several dozen and sometimes in difficult-to-reach locations, those extra minutes turn into hours of staff time. (Occasionally, these post-commissioning adjustments must be made at the end-user, a much larger allocation of time, plus travel expenses.)

Conversely, the initial setup of the SDBT-MSX doesn't require a power supply. The switch can be affixed to the actuator at a work bench, prior to installation. Once the actuator is in place, the SDBT-MSX cable is plugged into the controller. When the machine is powered on for commissioning and completes just four cycles, the SDBT-MSX's auto-teach capability automatically sets the correct final switching point without impacting the application.

"For us, not having to go back after commissioning and powering on the machine to individually adjust the position of each sensor is a huge timesaving, and helps streamline our production," says controls engineer Andrew Nauth.

Additionally, the end-stroke tolerance on the SDBT-MSX can be adjusted easily on the device within a range of 2-15 mm to adapt to different operating conditions. Typically, a standard cylinder switch may have a 2 mm detection range, fine for when the piston is hitting a hard stop on metal.

However, with vinyl or polymers that have some give, a soft stop can be a challenge for a legacy switch. Many of Pro-Line's CNC systems are cutting vinyl, and signaling the piston end stroke often requires a detection range greater than 2 mm. On some machines, Pro-Line has had to employ two legacy proximity switches on the same actuator to achieve a wider detection range, an additional cost in componentry, PLC logic and staff time. "So, being able to use just one switch, the SDBT-MSX, and adjust the tolerance to get the same result is definitely an advantage," Nauth says.

The Festo SDBT-MSX, affixed here to a compact rectangular cylinder, is unique technology: Its auto teach-in feature sets the switching point the first time and never needs follow-up adjusting like legacy proximity switches.

Using its capacitive teach button, the SDBT-MSX can be programmed for PNP (negative load) switching output or NPN (positive load), NO (Normally Open) or NC (Normally Closed) operation, so machine builders can bulk-purchase just one variant for all situations. For Pro-Line, that represents another potential cost efficiency, as it has begun to design new models with remote I/O. "Right now, we are buying (pre-defined) NPN (switches), but when we start using remote I/O, on those machines we will be using PNP," says Nauth. "So, for us it's an advantage to be able to stock the same switch for all machines, and not need multiple pre-defined types."

SDBT-MSX is set-it-and-forget-it technology. As a solid-state device, it's rated for hundreds of millions of cycles and will probably outlast any actuator on which it is mounted. It's ideal for new-builds and as a direct replacement for legacy switches on existing machines. BP

About Festo U.S.

Festo is a leading manufacturer of pneumatic and electromechanical systems, components, and controls for process and industrial automation. For more than 50 years in the U.S., Festo Corporation has continuously elevated the state of manufacturing with innovations and optimized motion control solutions that deliver higher performing, more profitable automated manufacturing and processing equipment. Through advanced technical and industrial education, Festo Didactic Learning Systems and its partners prepare workers for current and future manufacturing technologies. For more information, visit www.festo.com.

To read more ***Pneumatics*** articles, visit https://www.airbestpractices.com/technology/pneumatics.

Visit our Webinar Archives to listen to expert presentations on ***Pneumatics*** at https://www.airbestpractices.com/webinars.

Chiller & Cooling System Technology & Industry News

ASHRAE Standard 90.1-2022 Receives Determination from DOE

ASHRAE received a determination issued by the U.S. Department of Energy stating ANSI/ASHRAE/IES Standard 90.1-2022, Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings, will increase energy efficiency in commercial buildings subject to the code.

The standard achieved this determination through the DOE's technical analysis estimating buildings meeting 90.1-2022 (as compared to the previous 2019 edition) would result in a national average site energy estimate savings increase from 9.8% to 14% (reference as "net" savings).

"With the intensified demand for decreased energy consumption and carbon reductions in existing buildings, Standard 90.1 continues to offer essential guidance in shaping building regulations and amplified energy legislation," said 2023-24 ASHRAE President Ginger Scoggins, P.E., Fellow ASHRAE. "The DOE's latest determination further solidifies Standard 90.1 as the cornerstone for achieving energy efficiency goals and ultimately moves us closer towards widescale, global building decarbonization of the built environment."

The following are DOE's estimates of national savings in commercial buildings: 9.8% site energy savings, 9.4% source energy savings and 9.3% carbon emissions savings.

Standard 90.1-2022 marks the first time onsite generation of renewable energy systems is incorporated as a prescriptive requirement of the standard, recognizing the role of renewables in new construction, echoing similar requirements in several state and local building codes and better positioning new commercial buildings to achieve net zero energy in the future. Other key changes include customizable energy credits, a new mechanical system efficiency performance option, requirements to address thermal bridging, expanded criteria for whole-building air-leakage testing, updated lighting power allowances and additional guidance for using emissions in addition to traditional site, source and cost-based metrics.

States are required to certify within two years of DOE's affirmative determination that the provisions of its commercial building code regarding energy efficiency have been reviewed and, as necessary, updated codes to meet or exceed the updated edition of Standard 90.1.

About ASHRAE

Founded in 1894, ASHRAE is a global professional society committed to serve humanity by advancing the arts and sciences of heating ventilation, air conditioning, refrigeration, and their allied fields. For more information, visit ashrae.org.

Maurizio Coratella Named McDermott EVP, COO

McDermott announced Maurizio Coratella as Executive Vice President and Chief Operating Officer. In his new role, Coratella will apply his more than three decades of industry leadership and engineering and construction expertise to continue the momentum established by the company's growing backlog and expanding energy transition practice. He will lead delivery of integrated engineering and construction solutions across the energy value chain – from concept to decommissioning.

"Maurizio's expertise is a strategic supplement to an already-robust executive team," said Michael McKelvy, President and CEO of McDermott. "He shares our commitment to safe, responsible project execution to exceed the evolving needs of our customers and shape the future of global energy infrastructure."

Coratella spent much of his career in executive, operations and project leadership roles at large, international engineering and construction firms. In this capacity, he had oversight of upstream, midstream and downstream operations as well as engineering and fabrication across global locations. Throughout his career, he has driven innovation and advanced the energy transition by leveraging new technologies throughout the engineering and construction project lifecycles.

Most recently, he was Chief Operating Officer of a startup focused on carbon reduction in the steel industry. His early career was spent in the onshore and power generation sectors of the industry and included various operations,

McDermott named Maurizio Coratella Executive Vice President and Chief Operating Officer.

project management and engineering positions for large LNG, power generation projects in international locations such as Italy, Egypt and the Middle East.

Coratella served on the Board of Directors of Siirtec Nigi SpA, an engineering firm serving the oil and gas industry. In addition to various executive and leadership certifications, he holds a master's degree in industrial engineering from Politecnico di Milano.

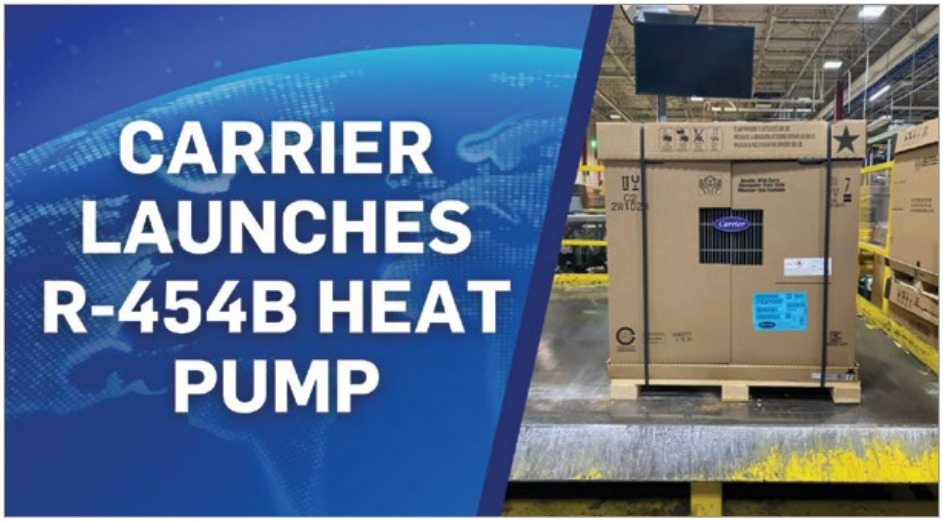
About McDermott

McDermott is a premier, fully-integrated provider of engineering and construction solutions to the energy industry. Our customers trust our technology-driven approach engineered to responsibly harness and transform global energy resources into the products the world needs. From concept to decommissioning, McDermott's innovative expertise and capabilities advance the next generation of global energy infrastructure – empowering a brighter, more sustainable future for us all. Operating in over 54 countries, McDermott's locally-focused and globally-integrated resources include more than 30,000 employees, a diversified fleet of specialty marine construction vessels and fabrication facilities around the world. For more information, visit https://www.mcdermott.com.

Carrier Launches Lower GWP Refrigerant Heat Pumps

Carrier's latest single-stage heat pump launch marks the first heat pumps available to the field that are R-454B compatible, well in advance of the 2025 regulatory shift. R-454B, known commercially as Puron Advance™, is Carrier's refrigerant of choice for all ducted and ductless residential and light commercial applications.

Additionally, Carrier was the first to announce its refrigerant of choice in 2018 and the first



Carrier advances sustainability by being the first to make lower GWP refrigerant heat pumps available for order.

to publish AHRI ratings for R-454B equipment. Carrier is a part of Carrier Global Corporation (NYSE: CARR), global leader in intelligent climate and energy solutions.

"Carrier distributors and dealers will lead the industry with our R-454B compatible units available for early training and installation," said Nick Arch, Vice President and General Manager, Residential HVAC Solutions, Carrier. "We continue to stress the importance of preparation and inventory management and are proud to be doing our part as the first manufacturer to get R-454B systems in the field."

With a GWP of 466 – a 75% reduction from R-410A – and non-ozone depleting potential, Puron Advance refrigerant was selected as the best solution to minimize environmental impact and provide longevity based on the United Nations Montreal Protocol Kigali Agreement phasedown plan. Carrier worked closely with regulators and research groups to develop standards, codes and regulations that will help ensure the safe use of R-454B. The recent designation of its Collierville, Tennessee facility as its Center of Excellence for heat pump production further underscores Carrier's commitment to sustainability.

In addition to heat pumps, Carrier also opened orders for R-454B compatible fan coils and evaporator coils. All available units will begin arriving in warehouses across the country in early April.

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, global leader in intelligent climate and energy solutions that matter for people and our planet for generations to come. For more information, visit https://www.carrier.com.

Chiller & Cooling System Technology & Industry News

Victaulic Acquires Utility Coatings & Fabrication

Victaulic, a leading manufacturer of mechanical pipe joining, fire protection and flow control solutions, acquired Utility Coatings & Fabrication, Inc. located in West Jordan, Utah. The acquisition supports the company's growth in the infrastructure, waterworks, energy and commercial construction markets by increasing capacity for large-diameter piping solutions, fabrication, and coatings and linings capabilities. It is also aligned with the strategy to manufacture these products in the United States.

"This acquisition represents Victaulic's fourth consecutive investment in the last four years, highlighting the company's strategic vision for ongoing growth," said Rick Bucher, President and Chief Executive Officer of Victaulic. "Victaulic remains dedicated to meeting the demands of our North American customer base through the expansion of manufacturing capacity in the western United States."

"This marks an exciting new chapter for our company. We are confident that merging the capabilities of UCF with Victaulic, a globally renowned industry leader, will open up new opportunities for growth and innovation for our collective customers," said Jeff Dahle, CEO of UCF.

A major aspect of Victaulic's business strategy has always been to manufacture products in close proximity to its customers. The addition of the UCF business includes over 21,000 square feet of manufacturing space and over five acres of land. Since 2011, Victaulic has added over 1.4 million square feet of foundry and manufacturing capacity in North America.

About Victaulic

Since 1919, Victaulic's innovative solutions and design services continue to increase construction productivity and reduce risk, ensuring projects are completed safely, on time and within budget. With more than 5,500 employees and 50 facilities worldwide, Victaulic helps customers in 140 countries succeed in the global

construction industry. For more information, visit www.victaulic.com.

About Utility Coatings & Fabrication, Inc.

Utility Coatings & Fabrication was founded in 1988 and is located in West Jordan, Utah. UCF provides expert services for manufacturing fabricated pipe and fitting solutions, as well as protective coatings and lining capabilities. For more information, visit https://www.utilitycoatings.com.

Daikin Applied Introduces New Navigator® WWV

Daikin Applied has introduced an enhanced Navigator® WWV water-cooled screw chiller with low-global warming potential (GWP) R-513A refrigerant. In addition to delivering industry-leading performance, customers can pair the new chiller with an optional Templifier® TWV water heater for an energy- and cost-efficient heat recovery solution. The combination of a low-GWP refrigerant and heat recovery configuration allows building owners and operators to trim utility costs, and accelerate their sustainability and decarbonization efforts.

"The Navigator WWV-Templifier TWV pairing delivers the high-quality performance the industry has come to expect with all-electric heat recovery to decrease onsite emissions," said Jim Macosko, Vice President of Product and Sustainability Solutions at Daikin Applied. "With the call to decarbonize HVAC expanding and growing louder, Daikin's continued innovation and enhancements allow our customers to meet the moment, optimizing the environment and their operations."

The Templifier TWV technology allows the Navigator to recover large amounts of heat that is typically rejected from the building and use it to produce hot water up to 140°F for processes or domestic hot water. Additionally, the Templifier can act as a boost to heat pumps for building heating. This aligns with the electrification trend occurring throughout North America and the world, as both the public and private sectors limit fossil-fuel combustion for heating and cooling facilities.

The Navigator heat recovery package not only provides significant environmental advantages, it also can increase energy efficiency and reduce utility costs for both HVAC and process applications, delivering a payback as rapid as one year.

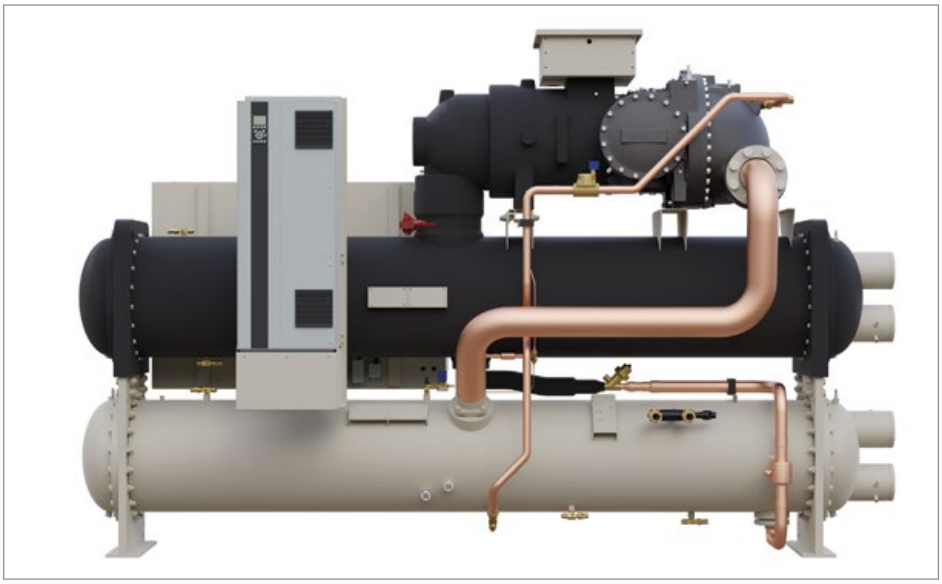
Navigator WWV provides superior part-load efficiency and sound reduction due to its unique-in-industry single-screw design with variable volume ratio compression technology.

Available from 120 to 300 tons, the Navigator is engineered for high-lift operation, making it an ideal fit for low-temperature processes and ice applications. Plus, the Daikin VVR technology adjusts to real-time building or process demands to deliver the most energy- and cost-efficient operation possible. Dynamically adapting to fluctuating heating and cooling demands ensures optimal temperatures, as well as humidity levels and noise.

Low-GWP refrigerant R-513A replaces industry standard R-134A in Navigator WWV, offering a more efficient solution for water-cooled screw chiller technology. R-513A cuts the GWP in half compared to R-134A, reducing the warming impact per pound of the refrigerant. The use of R-513A proactively addresses requirements in multiple states that require low-GWP refrigerants.

About Daikin Applied Americas

Daikin Applied, a member of Daikin Industries, Ltd., designs and manufactures advanced commercial and industrial HVAC systems for customers around the world. The company's technology and services play a vital role in creating comfortable, efficient and sustainable spaces to work and live – and in delivering quality air to workers, tenants and building owners. Daikin Applied solutions are sold through a global network of dedicated sales, service and parts offices. For more information, visit www.daikinapplied.com.



Daikin Applied's Navigator® WWV water-cooled screw chiller.

Chiller & Cooling System Technology & Industry News

New Danfoss PSH Compressor for Heat Pumps in Colder Climates

Danfoss' new PSH scroll compressor with vapor injection may be a game-changer for heat pump adoption. Its ability to operate in a wider range of ambient temperatures allows for an effective and efficient heat pump in colder climates. Increasing the operating range of heat pumps is essential for achieving decarbonization.

An R-454B optimized dedicated heat pump compressor with higher allowable discharge gas temperature limits, the PSH compressor with vapor injection is also multi-refrigerant qualified for R-410A and R-454B and simplifies the transition to R-454B, which has a lower global warming potential. It is designed for medium and high temperature applications (up to 65ºC) and low ambient operation. A large range of compressor capacities are available from 7.5-40 tons of refrigeration and individual compressors can be manifolded together to further increase system capacity.

To continue the increase of the market transition into heat pumps and extend the use into colder climates, the compressor combines the ability to use both liquid and vapor injection in the same product. Tandems and trios can also be used with a single economizer heat exchanger, which simplifies the system design and offers greater flexibility. The same compressor can be used for both R-410A and R-454B and in both liquid and vapor injection operating modes. It can be manifolded and used with a single economizer heat exchanger.

It is available in all required voltages and frequencies, which allows it to be used both in the United States and globally. The PSH compressor with vapor and liquid injection can be used in heat pumps in mild climate zones to areas where very cold climates are normal and expected. By increasing this operating range, it will further drive the market adoption of heat pumps and decrease the need to burn fossil fuels for heating.

"The PSH compressor with vapor injection is a game-changer in the path toward electrification," said Nick Mislak, Regional Segment Marketing Director for HVAC. "By enabling heat pumps to operate efficiently in colder climates, coupled with low-GWP compatibility, the PSH provides the technology needed to move toward clean heat sources while maintaining customer comfort."

About Danfoss

Danfoss engineers solutions that increase machine productivity, reduce emissions, lower energy consumption, and enable electrification. Our solutions are used in such areas as refrigeration, air conditioning, heating, power conversion, motor control, industrial machinery, automotive, marine, and off- and on-highway equipment. We also provide solutions for renewable energy, such as solar and wind power, as well as district-energy infrastructure for cities. Our innovative engineering dates back to 1933. Danfoss is family-owned, employing more than 40,000 people, serving customers in more than 100 countries through a global footprint of 95 factories. For more information, visit www.danfoss.us.

The PSH compressor's unique vapor injection technology allows for a wider range of operating temperatures.

THE MARKETPLACE

TECHNOLOGY & JOBS

COMPRESSED AIR BEST PRACTICES®
www.airbestpractices.com

ADVERTISER INDEX

Company	Page	Web Site
Kaeser Compressors	Outside Back Cover	https://us.kaeser.com/cabp
Atlas Copco Compressors	Inside Front Cover	www.atlascopco.com/air-usa
BEKO Technologies	Inside Back Cover	www.beko-technologies.us
KELTEC Technolab	5	www.keltecinc.com
Mikropor	7	www.mikroporamerica.com
Best Practices 2024 EXPO	8, 29, 46	www.cabpexpo.com
PneuTech Nitrogen	9	www.pneutech.com/nitrogen
SMC Corporation	11	www.smcusa.com
Sullivan-Palatek	13	www.sullivan-palatek.com
WCVC Networking Group	14	https://cabpexpo.com/womens-group/
Applied System Technologies	15	www.appliedsystemtech.com
Clean Resources	17	www.cleanresources.com
CDI Meters	19	https://cdimeters.com/
Best Practices Webinars	20, 32	www.airbestpractices.com/webinars
Hertz Kompressoren	21	www.hertz-kompressoren.com
Anest Iwata	23	www.anestiwata.com
Chicago Pneumatic Compressors	25	www.cpcompressors.com
Assured Automation	31	https://assuredautomation.com/
Compressed Air and Gas Institute	33	www.cagi.org/performance-verification
Compressed Air Challenge	39	www.compressedairchallenge.org

Advertising/Editorial Rod Smith • rod@airbestpractices.com • Tel: 412-980-9901
Subscriptions Administration Patricia Smith • patricia@airbestpractices.com • Tel: 412-980-9902
A Publication of Smith Onandia Communications LLC
37 McMurray Rd., Suite 104, Pittsburgh, PA 15241

THE MARKETPLACE

TECHNOLOGY & JOBS

METPOINT® FLM

Sensor Technology

Two temperature sensors are installed in series in the direction of flow. The first temperature sensor measures the current process temperature of the compressed air, while the second sensor is electrically heated to a temperature that is 40°C higher than that of the first sensor. Higher volume flows results in a quicker drop in temperature at the sensors, so that the electric heater of the second sensor must increase its heat output. The electric energy required to maintain the temperature difference is proportional to the volume flow. This energy consumption is converted to provide the relevant flow measurements.

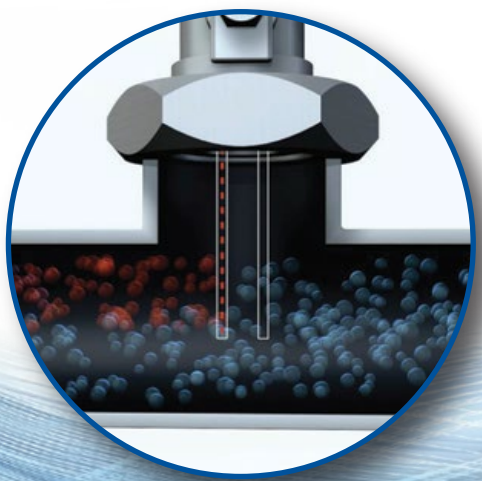
High Measurement Accuracy

Measuring instruments are designed specifically for compressed air applications.

Independent Reliability

Reliable measurement that is independent of temperature and pressure - no adjustment necessary.

Flow Sensor detail



Truth in Compressed Air
Reliable | Efficient | Innovative

www.bekousa.com +1 (800) 235-6797

The Hidden Costs of Compressed Air.

Compressed air is among your biggest power consumers; in fact the yearly energy bill for a compressor can surpass its initial cost. Further losses accrue from production downtime and scrap from unstable pressure or bad air quality.

KAESER provides the expertise to deliver consistent pressure and superior air quality throughout your facility, coupled with an energy-efficient system that delivers more air per kW.

Let's reveal your opportunities for signficant cost savings and production improvements.

SCHEDULE A SITE VISIT

KAESER COMPRESSORS®

us.kaeser.com/cabp • 866-516-6888