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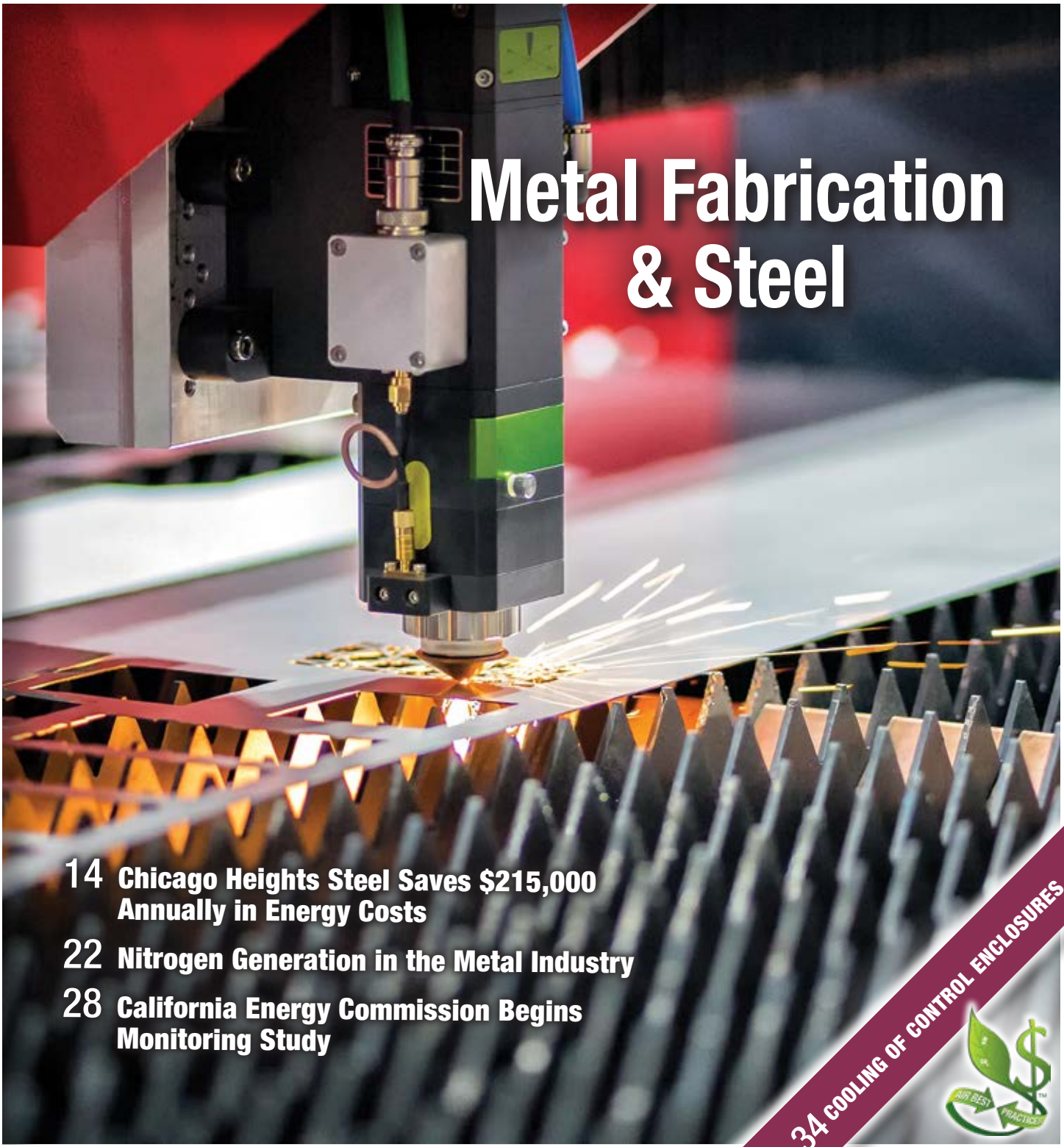
August 2018



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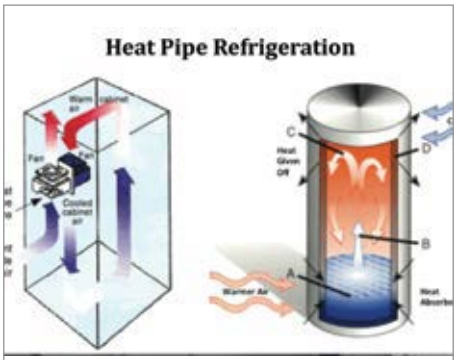

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FROM THE EDITOR | 2018 BEST PRACTICES EXPO & CONFERENCE

This August 2018 Issue will be distributed at our inaugural BEST PRACTICES EXPO & Conference taking place September 17-19, 2018 at the Chicago O'Hare Crowne Plaza. Register before August 17th for discounted rates at www.cabpexpo.com!

I'd like to thank all of you who have encouraged and supported us to make this event a reality. The compressed air industry in the U.S. has embraced the idea – as have many long-time readers from the energy management profession in corporate America's manufacturing plants.

The event will further our mission to encourage more Energy Projects relating to compressed air, blower, vacuum and cooling systems. The know-how assembled at both the Conference and the EXPO, blows me away. Co-sponsored by the Compressed Air & Gas Institute and by ComEd Chicago's Energy Efficiency Program, registration has been solid for the event. If you haven't signed up yet, however, please consider doing so – I really believe this event can help your company.

Our feature article this month is about Chicago Heights Steel, a recipient of a significant ComEd Chicago utility incentive check. Jan Hoetzel, from Airleader USA, was kind enough to invite me to personally see the positive effects of measuring and monitoring a compressed air system. After implementing a project creating $215,000 in annual energy savings, Chicago Heights Steel now monitors the specific power (kW per 100 scfm) of the system to ensure they "maintain the gain." This project brought together the factory, the technology/knowledge provider and the utility incentive - to make a factory more profitable and competitive – precisely why we publish this magazine and have launched the new event.

ENERGY STAR™ will be present at the event. They offer tools to factories to help them start an energy management program. They offer recognition for plants who reduce their energy consumption. If I ran an air compressor distributorship, I'd want to bring these tools to my customers. The SAFE QUALITY FOODS INSTITUTE will be there presenting. How many food industry plants have a written compressed air quality specification – with a COMPLIANCE VERIFICATION program? How vigorous are we at helping plants on the demand side? Why do compressed air leaks and inappropriate uses still exist? Come learn how to improve system design including blow-off air, AODD pumps, pneumatics, and dust collectors.

The compressed air industry has taken the lead in doing system assessments – we've overcome the mental block of teaching our clients to "use less compressed air." We've discovered our businesses can actually grow by providing this good advice! Well, the industrial vacuum and process cooling industries are where compressed air was 20 years ago. Great technologies, but not many folks teaching plants how to use less energy and water. I am now firmly convinced it's a great opportunity for those with system assessment training. Energy Managers will be presenting at the event and will confirm they can't find auditors able to tell them how to reduce vacuum or chiller utility expenses. Who can advise them how to move away from liquid ring vacuum pumps, without sacrificing reliability, so they can save $100,000 of chiller-related cooling water costs? What utilities have incentives designed to support this project?

We can do it – together. I hope to see you in Chicago, September 17-19. We'll also watch the Chicago Bears Home Opener at a Networking Event! Grab a flight and it's a quick shuttle drive away from O'Hare International Airport.

Thank you for investing your time and efforts into ***Compressed Air Best Practices®***.

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

2018 Expert Webinar Series
INSTRUMENT AIR: SYSTEM DESIGN & MEASUREMENT

Join compressed air expert, Mark Ames from John Henry Foster, to review the Quality Standard for Instrument Air ISA-7.0.01-1996 and explore how to design systems with varying dew points – rather than a constant -40 °F. Register and view our 2018 Webinar Calendar by visiting www.airbestpractices.com/webinars

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INDUSTRY NEWS

BOGE Investments Lay Foundation for Growth

BOGE has been synonymous with forward-looking compressed air solutions through intelligent engineering for 110 years. Its anniversary year, in 2017, saw the opening of the smart factory, and the creation of preconditions to fulfill customer's high demands for compressed air solutions. In the digitalized factory, people, component and machine communicate with one another to produce the parts for the prizewinning BOGE HST high speed turbo compressor to customer's specifications and to the highest quality. "Achieving this production line represented a major challenge for us," says Wolf D. Meier-Scheuven, managing partner at BOGE. "Thanks to the advanced production technology we are now in a position to manufacture in many versions and with process reliability. This is innovative and demonstrates our response to the continuously increasing requirements of our customers."

The BOGE managers look towards the future with optimism (from right to left: Wolf D. Meier-Scheuven, Michael Rommelmann, Gavin Monn, Ricarda Fleer and Thorsten Meier).

Innovation + Compressed Air = BOGE

In 2017, BOGE invested more than 5% of its turnover in research and development, about twice as much as the average invested by companies in the mechanical engineering sector. "We increased turnover and market shares, but due to our long-term investments, we suffered calculable losses in earnings," explains Thorsten Meier, BOGE's CEO. The smart factory alone cost the compressed air company around two million Euro. "We have thereby created the foundations for further growth," says Meier.

Best Industrial 4.0 Business Solution

The prize for the forward-looking continuous improvement programme from the Handelsblatt demonstrates BOGE is on the right track. The leading German business newspaper honoured the concept of continuous improvement for the high speed turbo compressor as the Best Industrial 4.0 Business Solution. With the help of data analysis and simulation, the compressed air experts are constantly further developing the hardware and software of the machines tailored to the customer. The compressors are therefore continuously improved in operation. The result: A highly efficient compressed air supply completely adapted to current requirements and extremely efficient in terms of energy, reducing operating costs.

"With our continuous improvement programme, we have taken a step forward in the race for the best digitalization strategies. Together with the BOGE high speed turbo compressor and the smart factory, we have reached the next level of innovation and can further extend our strong position as a highly specialised family-run company that is successful worldwide," says Wolf D. Meier-Scheuven.

It was the second time the jury has awarded BOGE the "Diamond Star" innovation prize. The jury included Dr.-Ing. Günther Schuh from RWTH Aachen University, who is eminent in Industry 4.0 professional circles. BOGE was up against renowned competitors such as Siemens, thyssenkrupp and Audi.

About BOGE Compressors

BOGE America is the USA based America's subsidiary of BOGE KOMPRESSOREN Otto Boge GmbH & Co. KG based in Bielefeld, Germany. Whether for centrifugal compressors, screw compressors, high-pressure piston compressors, scroll compressors, controls, air treatment equipment, complete systems or individual devices, BOGE meets the most diverse requirements and highest standards – in a precise and customer-oriented manner. BOGE solutions are used by all sectors of industry to supply compressed air for a wide range of manufacturing processes. The USA Operations of BOGE America stocks the various technologies of high-quality compressors and spares for immediate support to needs. Compressed air systems are designed, sold and serviced through a dedicated network of over 50 distributors in North, Central, and South America. The USA Operations is also the "Center of Excellence" for Technical Trainings for our partners to ensure Top Level Support for the consumer. For more information, please visit www.boge.com.

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INDUSTRY NEWS

Air Centers of Florida Acquires Arle Compressor

The parent company of Air Centers of Florida, announced its acquisition of Arle Compressor Systems Corp on May 10, 2018. The newly formed company, Arle Compressors of Florida (ACF), will continue to operate under the same branch in the Miami area, located at 10650 NW South River Drive, Medley, FL 33178.

Since 1987, Air Centers of Florida has been providing industrial air compressor sales, service and support in Northern and Central Florida. Since its inception, they have been Ingersoll Rand's Master Distributor for industrial air compressors and air treatment products in the region. In 2009 and 2015, ACF Inc. won the prestigious Ingersoll Rand North America Distributor of the Year.

Air Centers of Florida was founded in 1987.

Parent company, ACF Holdings of Tampa Bay, Inc. (ACF, Inc.), also includes ACF Tool and Hoist, a supplier of industrial tools, hoists and pumps, as well as ACF Standby Systems, Generac's Master Distributor for Industrial Generators in Northern and Central Florida.

Andy Young, ACF Inc. President, contributes the success over the years to his employees. "We've built our company with the customer in mind," Young expresses, "The ACF Golden Rule is to 'do unto the customer as you want to be treated as a customer.' We hire quality employees with high integrity, team attitude, a solid skill set and the ability to learn. Then we treat them like family. That is our secret sauce."

The ACF Family of Companies is headquartered in Tampa, Florida. They will now operate four districts throughout the region and continue to provide superior service and support to their customers from their main

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About Arle Compressor Systems

In 1982, Arle Compressor Systems was formed by Gus Arrieta and Lee Munoz. Together they built the company to be the premier air compressor equipment and service provider in South Florida. All of Arle's wonderful employees will continue to work at the new company.

About Ingersoll Rand

Ingersoll Rand is a global, diversified company that advances the quality of life by creating comfortable, sustainable and efficient environments. It is a $14 billion global business, with products ranging from complete compressed air and gas systems and services, to power tools, material handling and fluid management systems, with brands including Trane®, Club Car®, Ingersoll Rand®, and Thermo King®, and ARO.

For more information, please visit www.arlecompressor.com, or www.acfpower.com

Atlas Copco Extends Distribution with GenPros Partnership

Atlas Copco, a leading provider of sustainable productivity solutions, recently partnered with GenPros, LLC, a team of gas generator experts in Erie, Colorado, who specialize in the safe handling and distribution of industrial gases. GenPros is now a nationwide distributor of Atlas Copco equipment, including onsite nitrogen and oxygen generators.

"We're excited to be part of the Atlas Copco team. As a distributor of Atlas Copco products, we're helping our customers operate with greater efficiency, economy and productivity," said Nick Verini, president of GenPros. "Atlas Copco's wide range of nitrogen and oxygen systems helps us properly size systems to meet our customers' application demands."

Atlas Copco manufactures all components within their all-in-one nitrogen generation skid , from accompanying compressors to the filters and everything in between. Since Atlas Copco is the only manufacturer with this capability, GenPros can depend on a durable, reliable and cost effective products for their customers.

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INDUSTRY NEWS

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-a large foundry in Pennsylvania

As ambient conditions change, hydrogen may appear in liquid aluminum which can degrade the quality of the finished product. Passing nitrogen through the molten metal degasses the aluminum and improves finished product quality.

As demand for high quality aluminum has increased, a foundry in PA purchased a second nitrogen gas generator to meet the increased demand of their customers.

After successfully producing nitrogen on site using a nano gas generator, the foundry added a second model GEN2-1110 and further reduced their reliance upon the gas company.

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Ashcroft has opened a dedicated ISO 17025 accredited calibration laboratory.

"With GenPros' high level of expertise in the industry, they are a great partner when it comes to bringing value to our customers," said Craig O'Neil, a regional sales manager at Atlas Copco. "They understand our technologies and how they're suitable for applications in countless industries from food packaging to electronics, injection molding and more."

Atlas Copco is a world-leading provider of sustainable productivity solutions. The Group serves customers with innovative compressors, vacuum solutions and air treatment systems, construction and mining equipment, power tools and assembly systems. Atlas Copco develops products and services focused on productivity, energy efficiency, safety and ergonomics. The company was founded in 1873, is based in Stockholm, Sweden, and has a global reach spanning more than 180 countries. In 2016, Atlas Copco had revenues of BSEK 101 (BEUR 11) and about 45,000 employees.

Atlas Copco Compressors LLC is part of the Compressor Technique Business Area, and its headquarters are located in Rock Hill, S.C. The company manufactures, markets, and services oil-free and oil-injected stationary air compressors, air treatment equipment, and air management systems, including local manufacturing of select products. The Atlas Copco Group, which celebrated its 140th anniversary in 2013, is among the Top 100 sustainable companies in the world and a member of the Dow Jones World Sustainability Index. Atlas Copco has also been recognized by Forbes, Thomson-Reuters and Newsweek, among others, for its commitment to innovation and sustainability. Atlas Copco Compressors has major sales, manufacturing, production, and distribution facilities located in California, Illinois, Massachusetts, North Carolina, South Carolina, and Texas. www.atlascopco.us

GenPros, LLC has over 25 years of experience in the safe handling and distribution of industrial gases, and has designed, built and sold nitrogen generators in the past. GenPros will be actively pursuing applications for nitrogen and oxygen generators along with sales of all Atlas Copco air compressors, dryers, boosters and filters. Such applications include chemicals, biotech, pharmaceuticals, medical devices, energy, food and beverage, aquaculture, electronics, transportation, laser cutting, heat treatment, aerospace, semiconductors, injection molding, glass forming, water treatment, fiber optics and the U.S. military. www.n2o2generators.com

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CHICAGO HEIGHTS STEEL SAVES $215,000 Annually in Energy Costs

By Mike Grennier, Contributing Editor, Compressed Air Best Practices® Magazine

Chicago Heights Steel's operation.

➤ Chicago Heights Steel, Chicago Heights, Ill., leveraged an advanced data monitoring system and adopted a demand-based compressor air management approach to save 2.5 million kWh and $215,037 per year in energy costs. With an incentive of $188, 714 from local utility ComEd, the project delivered a payback of 2.4 months.

The approach also incorporated modifications to the compressed air system, including replacement of poor-performing fixed-drive air compressors with VSD units – among other changes – to precisely match compressed air supply to demand. In all, the project has reduced compressed air use by 70 percent.

Background

Many industrial companies look to address the high costs to power their compressed air systems. Among them is Chicago Heights Steel, which set out to gain control of the costs – as long as it could implement a highly cost effective approach. Chicago Heights Steel (www.chs.com) is the only specialty steel

> "Over the years, we've seen our energy usage and the corresponding costs increase. I wanted to know where we're using all of this electricity. I also wanted to understand where we're using all of this compressed air since we added horsepower to meet the need for it."
>
> — Bradley Corral, Chicago Heights Steel President

market mill in the United States that rolls billet and rail steel in addition to supply a range of products to customers.

Chicago Heights Steel President Bradley Corral said his goal was to better understand compressed use in the plant, especially since the company had added air compressors to its operation from time to time over the years to meet drops in system pressure throughout the plant. He also wanted the ability to more closely evaluate electrical usage plant-wide.

"Over the years, we've seen our energy usage and the corresponding costs increase. I wanted to know where we're using all of this electricity," Corral said. "I also wanted to understand where we're using all of this compressed air since we added horsepower to meet the need for it."

Two independent companies performed ComEd air compressor system leak studies that were left unfinished. Needing more answers and a cost-effective approach to address the issue, Chicago Heights Steel consulted with Jan Hoetzel, Executive Board Member of the Compressed Air Challenge http://www.compressedairchallenge.org/executive-committee and Principal of Airleader USA, Grand Rapids, Mich. Airleader (www.airleader.us) is a provider of compressor energy management software and tools to reduce compressed air costs.

The Importance of Data Collection

Hoetzel immediately knew data collection was the only way to effectively identify the issues driving high compressed air costs and what needed to be done to address them. He also knew the value of historic data over the course of months, not weeks.

"I'm not a big fan of taking on major projects and recommending substantial investments

CHICAGO HEIGHTS STEEL SAVES $215,000 ANNUALLY IN ENERGY COSTS

Chicago Heights Steel President Bradley Corral (left) displays the incentive check from ComEd for the compressed air system upgrade. Also pictured are Chicago Heights Steel General Electrical Supervisor Jim Stolte (middle) and Airleader USA Principal Jan Hoetzel.

with only two weeks of data," Hoetzel said. "What is much better is to view up-to-the-minute data, capture months of that same data and compare it month to month. Only then can you make informed decisions."

Initially, Hoetzel picked up where others left off and completed a complimentary leak study at Chicago Heights Steel, which operates two air compressor rooms. The study showed substantial compressed air leakage, which led to repair of the fixed leaks for a monthly average savings of approximately 40,000 kWh. However, the savings were not captured because the air compressors had been run in modulation.

Yet Hoetzel knew Chicago Heights Steel could achieve greater energy savings if it invested in data collection and a number of yet-to-be determined changes to its compressed air

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system. The challenge for Hoetzel was to prove the value of investing in data monitoring to controls to Corral. As such, Corral decided to have the Airleader Compressor Master Control and Online Monitoring System installed on the compressed air system to one compressor room on a pilot basis. The baseline snapshot of the system would allow Hoetzel and Corral to make decisions on changes to the system based on data rather than educated guesses or assumptions.

Original Compressed Air System and Initial Data

Chicago Heights Steel originally operated three air compressors in each of its two compressor rooms. Each room operated on two different system pressures.

Compressor Room I

- One 150 hp fixed-speed modulating air compressor
- One 200 hp fixed-speed modulating air compressor
- One 75 hp fixed-speed modulating air compressor
- One desiccant compressed air dryer

Compressor Room II

- One 200 hp fixed-speed modulating air compressor
- One 150 hp fixed-speed modulating air compressor
- One 75 hp fixed-speed modulating air compressor
- One desiccant compressed air dryer

Chicago Heights Steel manually controlled the air compressors and normally operated five of the six units in modulation virtually non-stop

CHICAGO HEIGHTS STEEL SAVES $215,000 ANNUALLY IN ENERGY COSTS

during production. A two-inch pipe connected the two compressor rooms, although each room operated independently from the other and the pipe was essentially unusable for compressed air control.

Effectively monitoring the compressed air system required the installation of kW meters on each air compressor. Also installed were flow meters and dew point sensors in each compressor room.

The master control system gave Hoetzel and Corral the ability to view real-time data at any time from their offices to gain insight into air compressor performance and understand the true cost of the compressed air system, down to the second. Importantly, the controller provided Chicago Heights Steel with the data it needed to make incremental changes to the compressed air system – including the ability to leverage energy savings and an incentive program offered by ComEd to fund improvements.

CHICAGO HEIGHTS STEEL		KPI	FLOW		KW		TIME (S)	
ID	DESCRIPTION	KW/100 CFM	RATED	MEASURED	LOAD	UNLOAD	UNLOAD	NOTE
1	#1 200HP	30.5	850	410	125	75	300	Modulation
2	#2 150HP	17.7	670	679	120	48	240	
3	#3 75 HP	22.2	370	234	52	15	240	InletValve Issues
4	#4 150HP	18.5	740	659	122	48	300	
5	#5 150HP	18.8	650	512	96	n/a	300	
6	#6 75HP	15.9	370	370	59	25	300	

Master controller data gathered on the original air compressors.

Thermal Mass Flow Meter and Dew Point Sensors were installed in each air compressor room. Photos courtesy of CS Instruments.

Incremental System Improvements and Savings

With the master control system, both Hoetzel and Corral were able to establish benchmarks for performance and evaluate a wealth of data including load and idle operation, consumed kWh, air generated and energy costs based on local utility rates, and performance parameters for each air compressor. The system also provides real-time information on overall compressed airflow and dew points.

During the initial four-month period from December to March, data demonstrated no significant savings had been achieved solely by fixing the compressed air leaks. It also showed how the desiccant compressed air dryers resulted in a huge energy drain given the need to purge desiccant. Based on the data and an incentive program offered by ComEd, Corral opted to replace the desiccant dyers with cycling refrigerated compressed air dryers, allowing Chicago Heights Steel to reduce compressed air use by as much as one-third.

The information convinced Corral of the value in compressed air system data measuring and monitoring. That led to the extended use of the master control system for both air compressor rooms.

In addition, the savings combined with the ComEd incentive made it economically feasible to replace the 2-inch pipe connecting the two air compressors rooms with a 4-inch pipe. The new pipe was essential for free airflow and the ability to use the Master Control System to supply the compressed air to the plant from the appropriate air compressors from any compressor room.

Demand-based Compressed Air Approach Implemented

As a next step in the project, Chicago Heights Steel and Airleader set out to optimize the compressed air system to satisfy demand for air at the lowest possible cost.

CHICAGO HEIGHTS STEEL		KPI ORIGINAL	KPI NEW
ID	DESCRIPTION	KW/100 CFM	
1	#1 200HP	30.5	
2	#2 150HP	17.7	17.7
3	#3 75 HP	22.2	
4	#4 150HP	18.5	
5	#5 150HP	18.8	18.8
6	#6 75HP	15.9	15.9
7	#7 200HP VSD		17.02
8	#8 75HP VSD		19.8
9	#9 150HP		16.05

Key Performance Indicator (KPI) data on the upgraded compressed air system. Chart courtesy of Airleader USA.

Chicago Heights Steel President Bradley Corral with a new rotary screw air compressor.

Optimization started with data. The master control system's data confirmed that the most effective approach delivering compressed air was for Chicago Heights Steel to end the practice of running its five compressed air units continuously in modulation. That led to the implementation of a demand-side approach to managing its compressed air.

The approach hinges on the use of Variable Speed Drive (VSD) air compressors that operate based on air demand and the use of the master control system to automatically control the operation of the compressors involved. Savings achieved to date also played a key role in the decision to proceed with a new compressed air configuration and

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CHICAGO HEIGHTS STEEL SAVES $215,000 ANNUALLY IN ENERGY COSTS

additional compressed air storage capacity. The data collected and savings together cleared the path for the air compressor equipment upgrade, the cost of which would be offset by the ComEd incentive of $177,714. Earlier, ComEd had provided an incentive of $11,000 for the compressed air system leak repair.

The team analyzed data from the master controller and decided to replace three fixed-drive air compressors with new units based on performance output and the remaining productive life of the existing units. The data also demonstrated further savings potential, which further fueled the decision to proceed with the upgrade. The new compressed air system is as follows:

Compressor Room I

- One 150 hp fixed-speed air compressor (original unit)
- One 200 hp VSD air compressor (new unit)
- One 75 hp VSD air compressor (new unit)
- One cycling refrigerated compressed air dryer (replacing desiccant dryer)

Compressor Room II

- One 150 hp fixed-speed air compressor (new unit)
- One 150 hp fixed-speed air compressor (original unit)
- One 75 hp fixed-speed air compressor (original unit)
- One cycling refrigerated compressed air dryer (replacing desiccant dryer)

Today, the system supplies compressed air throughout the plant typically via the new 200 hp VSD air compressor in combination with the 75 hp VSD unit. The remaining equipment is available as needed and serves as a redundant system.

The air compressors, however, do not load and unload as with a sequenced system operating in modulation. Instead, the master control system automatically balances the operation of the VSD units to meet the

demand for air. Typically, the larger VSD air compressors run continuously until they begin to approach peak capacity. At that point, the system blends in the small load unload compressor, in turn, reducing the demand on the larger unit to achieve peak operational efficiencies. The smaller unit is only used when the demand is way down on weekends or late at night.

Results

This project resulted in an overall decrease of 2,582,979 kWh, for an annual savings of $215,037. The costs for the Master Controller and ongoing monitoring, as well as upgrades to system piping, storage and the three air compressors totaled $240,139. Including the ComEd incentive of $188,714, the project achieved a simple payback of 2.4 months.

The project was a success given the results, said Hoetzel. In addition, it clearly demonstrates the value of ongoing monitoring of compressed air systems is as an industry best practice by any measure.

"The opportunities for improvements would not have been discovered without permanent monitoring in place," said Hoetzel. "Data is absolutely essential in order to make a true evaluation of the compressed air system and the steps needed to achieve system efficiencies."

Corral said he appreciates the ability to see up-to-the-minute data on the compressed air system because it provides critical insights he wouldn't have had before.

"The monitoring and control system is extremely successful," he said. "I love the visibility it gives me. Anytime I see a jump in compressed air or electrical usage I can go down to the maintenance department or other areas of the plant and find out why. We can then change behaviors, such as wasting compressed air, or fix something that needs to be fixed."

Looking ahead, Corral plans to examine other major areas of electrical power usage in the plant and possibly one day connect the other systems to the monitoring and control system.

"Being able to get this kind of information allows us to understand the electrical usage and ultimately lower our costs," Corral said. BP

For more information about the Airleader's compressor master control and monitoring system, contact Jan Hoetzel at jan@airleader.us, or 616-828-0716.

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	PLANT PRESSURE			
	MIN	AVERAGE	MAX	PRESSURE BAND
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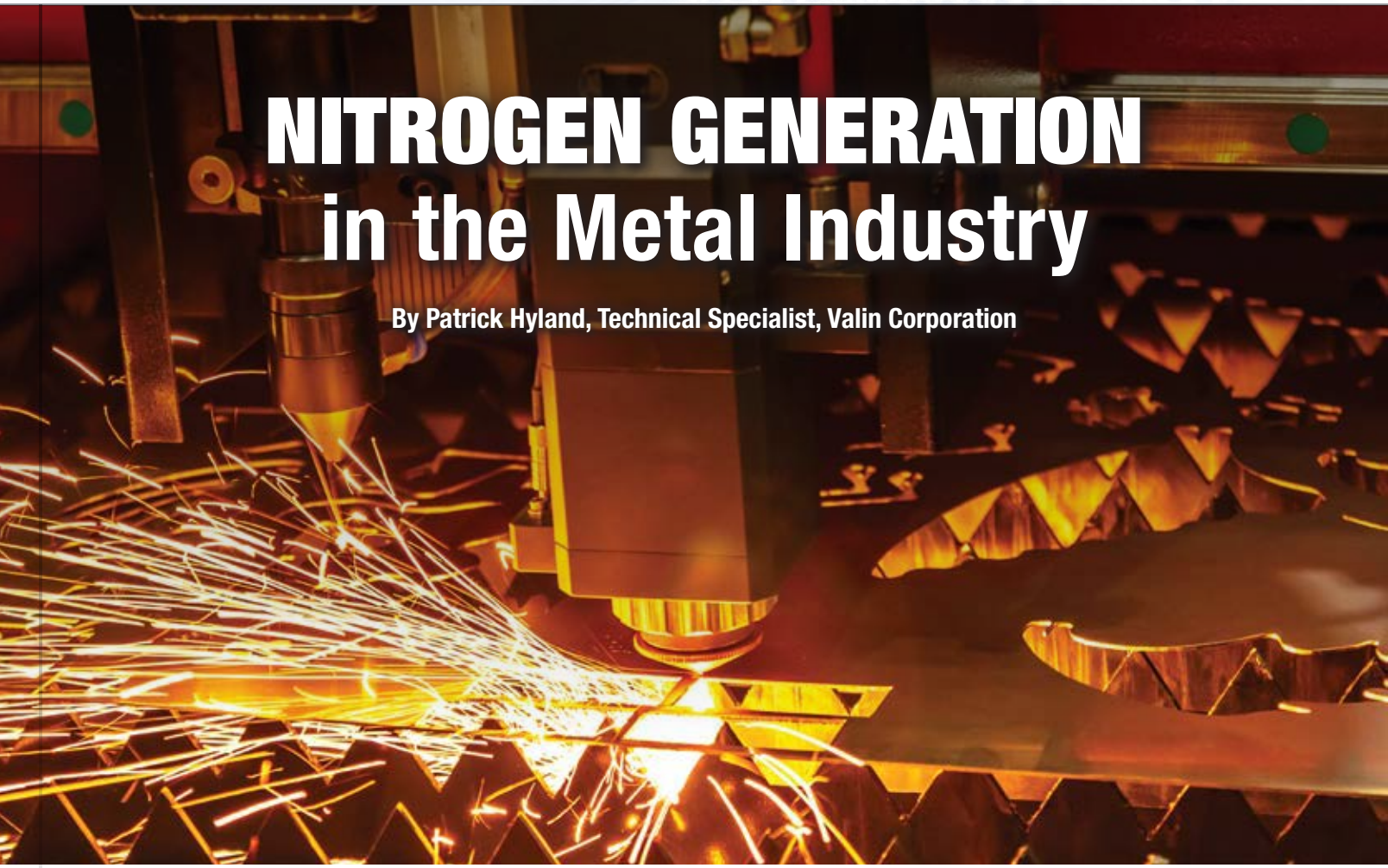
*Based on data during production time

The air compressor system upgrade resulted in a considerable decrease in compressed air plant pressure throughout the plant. Chart courtesy of Airleader USA.

For more stories about ***Compressed Air System Assessments,*** visit www.airbestpractices.com/system-assessments



NITROGEN GENERATION in the Metal Industry

By Patrick Hyland, Technical Specialist, Valin Corporation

Manufacturers in the metal processing industry are always looking for the most cost-efficient and effective solutions to their process. At many plants, lasers are employed for cutting metals like steel and aluminum. These laser cutters often utilize nitrogen to eliminate moisture and oxygen from certain parts of the process. In the past, bulk storage systems have been used to house nitrogen on-site at the manufacturing plants, but this method of storage can result in a significant loss in revenue when all is said and done. So, what is the solution for plant owners? The answer begins with in-house nitrogen generation systems.

First, it is important to explore the use of nitrogen in these processes in order to understand the effects of and differences between bulk storage systems and nitrogen generation systems. Factory lasers use nitrogen right at the cutting point on the metal because the high temperatures used in the process can often cause oxidation. When

"Nitrogen generation systems are a unique way to provide a sustainable approach to supplying nitrogen in metal manufacturing and many other industries."

— Patrick Hyland, Technical Specialist, Valin Corporation

oxidation occurs, the metal pieces being cut can be damaged, as can the tooling creating the cut. Structural damage or inaccurate cuts can make parts weak and render them useless. The use of nitrogen at the point of contact from laser to metal removes oxygen from the cutting area and helps cool the die as it cuts, thus preventing oxidation. This prevention improves the quality of the final products, produces less scrap metal and cuts back on the reworking of pieces.

Bulk Storage Systems

The first way that manufacturers can go about bringing nitrogen to the injection point on the laser is fairly simple in its execution. A typical bulk storage system consists of a tank, a vaporizer and controls. There are other types of bulk storage, but this is one of the most common systems. A supply of liquid nitrogen is housed in a large tower or tank located in the facility and nitrogen gas is pulled directly from this supply. The typical flow path for these units starts at the bulk tank and runs into an ambient air vaporizer. From there the nitrogen enters the piping and flows through regulators, depending on system design, and then goes out to process.

Nitrogen Generation Systems

Nitrogen generation systems are a unique way to provide a sustainable approach to supplying nitrogen in metal manufacturing and many other industries. There are two types of nitrogen generators: a pressure swing absorption (PSA) and a membrane. A PSA system uses a carbon molecular sieve to adsorb oxygen under high pressure while allowing the nitrogen to pass through. A membrane uses hollow, porous fibers to separate the N_2 molecules from the other molecules present in oxygen.

A typical nitrogen generation system for a laser cutting application will have the following components: nitrogen generator, storage tanks, high-pressure booster and high-pressure storage cylinders. Most laser cutting applications will require a PSA generator to accomplish the desired flow rates and purities. Laser cutting applications require high flow rates and high pressures, which is why all nitrogen generator systems are designed to fill 6, 12, 18 or 24 packs of bottles with nitrogen gas instead of delivering the gas directly into the application. When designed and sized correctly, these systems run efficiently and require very little monitoring.

Nitrogen generation systems utilize compressed air — a process that obviously begins with a compressor. The compressor pulls air from the surrounding atmosphere, at which point it passes through a high-efficiency coalescing filter and a dryer. This filter and dryer will remove oil, water and particulates that could damage the generation system. If the system in question is a PSA generator, after moving through the filter the dried air will make its way to an additional pre-filter before entering the nitrogen generator. After the generator, the nitrogen is delivered into the high-pressure booster where it is boosted to 2,500psi or 5,000psi depending on the system design. Once the nitrogen has reached the high pressure it is delivered to the pack of cylinders where it is stored until needed. At any point when the nitrogen is needed,

NITROGEN GENERATION IN THE METAL INDUSTRY

it passes through a regulator that is set to the desired pressure for the application and piped to the laser cutter.

Advantages, Disadvantages and Maintenance

The list of advantages that accompany using a nitrogen generation system as opposed to a bulk storage system is long and promising. As it is currently, the manufacturing industry sits somewhere around a 50/50 split of plants that use one or the other. There are a few reasons for this, one being that a nitrogen generation system is a big cost to a manufacturer upfront. Investing hundreds of thousands of dollars on a piece of equipment always seems like bargaining for an ROI that makes the expense worthwhile. Though a return on investment is relative to what application the generation system is being used for, manufacturers can sometimes see payback as early as six months after implementation.

A large portion of the savings come from the fact that the system is being bought outright, and a plant owner is not beholden to a multi-year contract from a nitrogen supplier. This cuts a number of costs including rental fees, annual supplier costs and delivery fees. Relying on an outside supplier for nitrogen can also mean conflicts in delivery scheduling. Most manufacturers run their laser cutter a minimum of twice a day and if they find themselves at the end of their supply of nitrogen before their next scheduled delivery, they have no other option than to wait. Downtime for these laser cutters can

A nitrogen generation system utilizes compressed air to generate nitrogen on-site.

result in a large chunk of revenue loss. With nitrogen generation systems, however, the supply of air is never gone and its availability does not rely on an outside, third party.

Another chunk of savings comes from the prevention of head loss from a waste of nitrogen that occurs when using a bulk storage system. Because a generation system can be turned on and off, it is only used when necessary and can produce only the specific amount of nitrogen needed; This saves on and essentially eliminates the waste of gas. When using bulk storage systems, the purity of nitrogen being pumped into an application will almost always be near 99.998%. At first glance, that seems like an advantage but if a process does not require that level of purity then the system is not running as efficiently as possible. This is part of the reason why bulk systems seem more cost-efficient upfront but fall behind in the long run. Most nitrogen generation systems allow the user to set their own purity rate that can be tailored to what is required for their process.

Because it is absolutely critical to deliver clean, dry air to the nitrogen generator, the system is equipped with multiple filters and components that will ensure this happens. These elements are designed to remove water, oil and other contaminates and must be maintained in order to get the best life expectancy from the system as a whole. A properly cared for generation system can stay in place for 15+ years. The proper preventative maintenance that accompanies a nitrogen generation system will typically run a manufacturer around a couple thousand dollars per year, depending on their application. Pre-filters usually need maintenance every six months to a year, and

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Track 1, Session #2

Working Together as the United Voice of the Compressed Air Industry
Chair: Chad Larrabee, Education Committee Chair, Compressed Air & Gas Institute

Industry Trends in Compressed Air Efficiency
Brian Freeman, Second Vice President, CAGI

How to Compare Performance Claims to Ensure the Highest Efficiency
Dave Prator, Immediate Past President, CAGI

Quick Hits to System Optimization
David Booth, System Assessment Section Member, CAGI

Are You Hiring the Right Professional to Assess Your Compressed Air System?
Wayne Perry, System Assessment Section Chair, CAGI

NITROGEN GENERATION IN THE METAL INDUSTRY

the filters within the nitrogen generator will need changing every six months. The generator itself will require maintenance once every year, and the pre-filters in the desiccant dryers should be changed every six months to a year. The booster compressor is most often run on an hourly-based servicing schedule. Like the compressor, the maintenance of all elements in the system could increase or decrease in frequency from these benchmarks depending on the process they are being used for.

Making the Switch

The average transition from bulk storage to nitrogen generation typically takes six months to year or longer for most manufacturers.

The first step facility operators need to make in the transition is figuring out when the contract with their nitrogen suppliers ends. Once that is determined, a complete report of their system requirements is essential. Some important factors to consider are the purity, flowrate (SCFH) and delivery pressure required in the process. Once manufacturers have this information they should reach out to a nitrogen generator supplier and work with them to quote a system that meets their needs. During this quoting process, suppliers will most likely give several quotes ranging in price, benefits and lead time. It is important to fully understand each supplier's design because there is still a wide range of variables in these systems that can affect longevity, service and the manufacturing process as a whole. BP

About the Author

Patrick Hyland is a Technical Specialist who specializes in Filtration for Valin Corporation, a leading technical solutions provider for the technology, energy, life sciences, natural resources and transportation industries. Valin offers personalized order management, on-site field support, comprehensive training and applied expert engineering services utilizing automation, fluid management, precision measurement, process heating, filtration and fluid power products.

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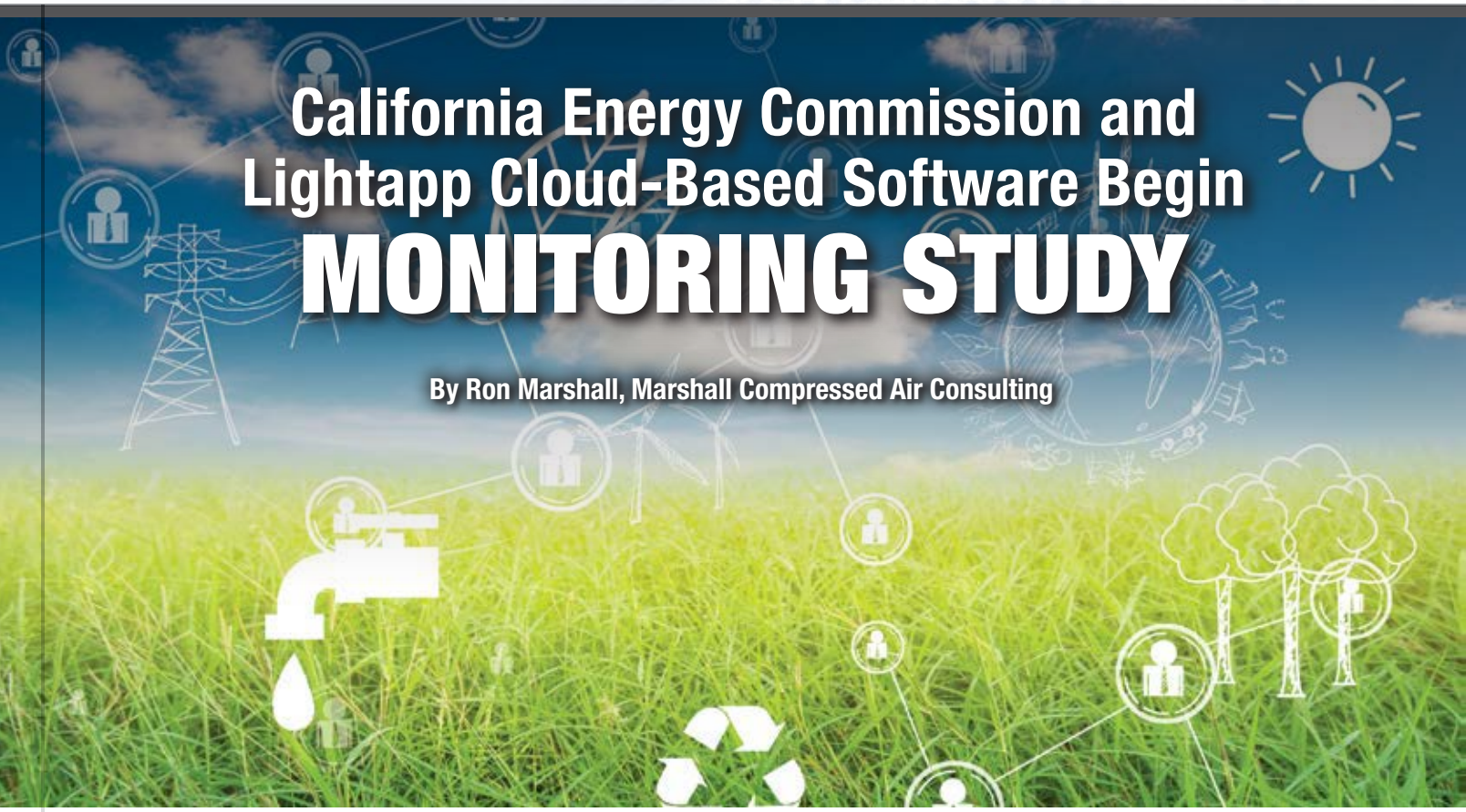

California Energy Commission and Lightapp Cloud-Based Software Begin MONITORING STUDY

By Ron Marshall, Marshall Compressed Air Consulting

➤ As energy costs continue to rise it becomes increasingly important for industrial operations to reduce waste and inefficiencies wherever possible. It's why an innovative company known as Lightapp has developed an intelligent resource management software platform to help manufacturers and other industrial users reduce energy consumption and save costs in the process.

According to Lightapp, energy consumption is often among the highest items in many manufacturing plant's operational budgets, sometimes second only to raw materials. Energy costs are driven in large part by a variety of systems such as air compressors, chillers, production lines, boilers, and dryers.

When it comes to saving energy, it's a virtual "battlefield" reports Lightapp. This article discusses how Lightapp's cloud-based software solution helps companies across the world monitor compressed air systems and win the energy-savings battle.

Background

Founded in 2009 by CEO Elhay Farkash and COO Guy Peer, Lightapp (www.lightapp.com) is a privately held company based in Israel. The company also has an office in Menlo, Calif. The company's analytics software solution – also called Lightapp – is specifically designed to collect energy data and give decision-makers at industrial plants the information they need to reduce energy consumption.

The software solution, in combination with in-plant data collection hardware, gathers data from new and existing industrial sensors, as well as information from manufacturing information systems. It also collects external data like weather related information. It then generates reports to help users understand how and where energy is consumed.

Since its inception, more than 150 manufacturers in Israel and the United States have used Lightapp to achieve significant energy savings. As an example, Israeli dairy producer Tnuva used the software to realize a 36% reduction in total plant energy reduction.

Others in the United States have also experienced success with Lightapp, thanks in part to funding from the Israel-US Binational Industrial Research and Development (BIRD) Foundation in 2014. BIRD promotes mutually beneficial collaboration between Israeli and American companies in various technological fields.

BIRD funding played in instrumental role in the development of a resource optimization system for paper manufacturer Pratt Industries, Conyers, Ga., which also owns the distinction of being one of the first U.S. Lightapp installations.

Pratt Process Engineer Bob Pelchat helped develop and implement the system, which monitors hundreds of sensors on the company's paper machines.

"I like the system because it lets me get a quick look at key performance indicators in real time," said Pelchat, "We monitor many of our utilities in order to measure energy, steam, water, gas, compressed air and other items. The system is set up to report how much of each utility is used per ton of paper in keeping with our target to reduce each input."

The solution has helped Pratt achieve significant energy savings, but Pelchat said the major benefit is reduced downtime. As an example, he said Lightapp monitors 200 or so motors at various locations within the plant. The readings from the motors show loading conditions and other important parameters. The readings, and various warnings pre-programmed into the software, allow Pratt to preemptively replace questionable motors during downtime based on their reported condition – and as a result – avoid process outages due to random failures. This saves a huge amount of money by increasing process reliability. "The energy efficiency is nice," said Pelchat, "but it is not our biggest priority."

Compressed Air Monitoring

Based on a $5 million grant from the California Energy Commission (CEC) operations throughout California will also soon experience the advantages of Lightapp, pending the results of a successful trial project involving 100 industrial facilities. CEC awarded the grant to Lightapp and the E2e project, which is a joint initiative of the University of California, Berkeley, Massachusetts Institute of Technology, and University of Chicago.

The grant, awarded based on the Lightapp and E2e's previous successes, will be used to conduct what CEC describes as the largest evaluation of an innovative energy monitoring system for industrial facilities. The grant is also part of CEC's Electric Program Investment Charge (EPIC) program, an ambitious effort to develop and demonstrate the next generation of energy technologies to address California's clean energy goals.

As reported by CEC: "The project will provide industrial customers and policymakers data-based evidence on whether advanced energy monitoring is a cost-effective approach to save energy and reduce greenhouse gas emissions."

For this project, E2e and Lightapp will test Lightapp's energy-monitoring system on the 100 facilities' compressed air systems. Air compressors and the equipment they drive account for around 10 percent of the electricity used by manufacturers. In some plants, compressors use more electricity than any other equipment. With a leaky compressor valves, money is literally disappearing into thin air.

Figure 1: Electronic Monitoring gathers various sensor data and sends it to a cloud database for processing and visualization

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CALIFORNIA ENERGY COMMISSION AND LIGHTAPP CLOUD-BASED SOFTWARE BEGIN MONITORING STUDY

Figure 2: The baseline system efficiency for Pepsico Fresno, before monitoring, was an unacceptable 57 kW/100 cfm (Source Lightapp)

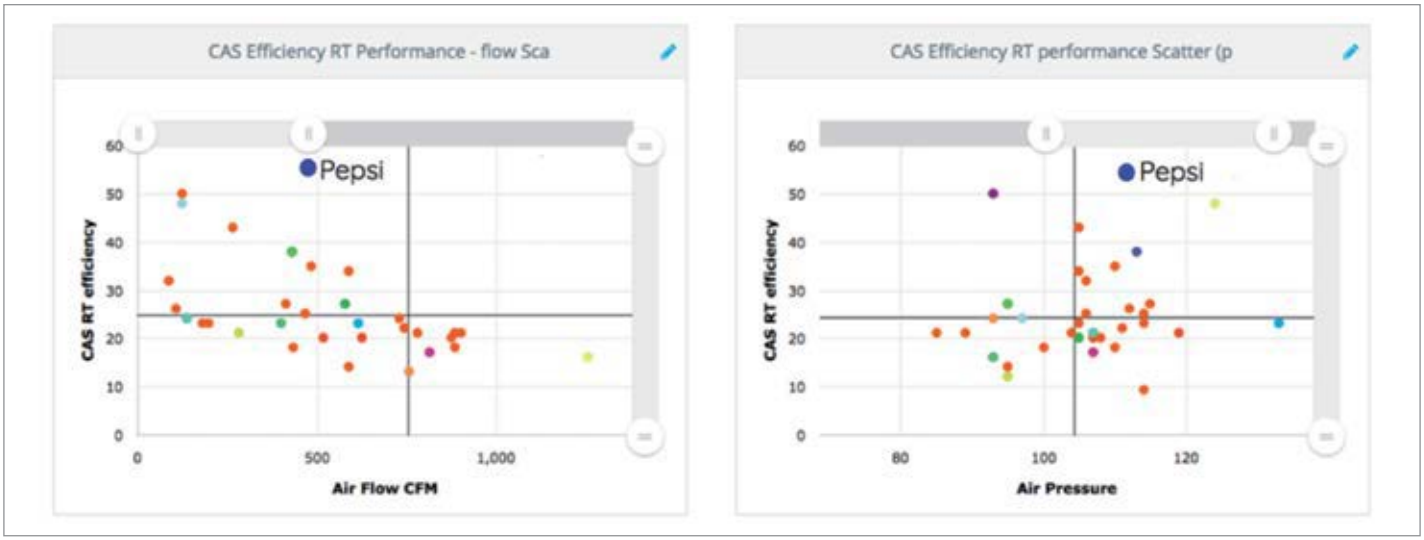

Figure 3: Scatter plots showed Pepsico Fresno was an outlier for both system efficiency and air pressure compared to similar systems. (Source Lightapp)

If successful, the technology can be used throughout a facility to measure energy consumption in every part of the manufacturing process. E2e will structure the evaluation component of the program as a randomized controlled trial, where randomly chosen facilities will be recruited to participate and receive Lightapp's analytical software.

This arrangement will enable the faculty researchers – Catherine Wolfram (Berkeley-Haas), Michael Greenstone (University of Chicago), and Christopher Knittel (MIT) – to precisely measure the impact of the new technology and analytics on industrial facilities' electricity consumption.

By including a sampling of facilities from different industrial sectors, the researchers also hope to identify which types of facilities are more likely to adopt the new technology and gather information regarding potential barriers to adoption. The project aims to generate rigorous and reliable evidence on the effectiveness of an industrial energy-management system. The findings can be used to encourage thousands of California manufacturers – and more worldwide – to deploy energy management systems to save energy, lower costs, and reduce carbon emissions.

Eye-Popping Results Early On

The project has shown eye-popping energy savings and/or efficiency improvements early on at a number of operations. In keeping with the old saying, "You can't manage what you don't measure," project participants with the support of Lightapp staff have discovered significant inefficiencies. In addition, many have often corrected the issues with very low-cost solutions. Others have been able to defer the purchase of new compressed-air production equipment based on the data obtained.

Packaging Company

A packaging company engaged in the project reports how it was able to avoid the need to invest in new equipment and piping to address a plant pressure problem.

"The Lightapp information was very useful in helping troubleshoot our plant pressure problems," said Dragan Militiev, the plant Process Engineer at the time of implementation. "It showed our issues were not compressor-capacity related, but due to a high level of leaks and an undersized air dryer."

According to Militiev, continuous monitoring and the availability of data showed what exactly the pressure was doing in the plant under various conditions, and narrowed the pressure problem to a lower -cost solution. The plant had originally planned to add two new compressors and upgrade a long length of supply piping at a cost of $120,000. However, new information showed that repairing leaks and replacing the dryer, at much lower cost, would fix the problem, saving unnecessary equipment purchases.

Pepsi Fresno

Pepsico in Fresno, Calif., is another example of a company that had a Lightapp system installed on its compressed air system as part of the study.

The system monitors both high-pressure PET system and the 100 psi plant system. Before the installation the plant did not track energy or flow related information on the systems. Two large air compressors are used on the main plant low-pressure system. These include a 200 hp VSD compressor and a larger 300 hp fixed-speed unit.

CALIFORNIA ENERGY COMMISSION AND LIGHTAPP CLOUD-BASED SOFTWARE BEGIN MONITORING STUDY

From the start, monitoring showed that the system was not performing very well, with system specific power, a measure of the energy input (kW) compared to 100 cfm output (called the specific power), running near 57 kW per 100 cfm (Figure 2), which is considered very poor.

In looking at the data, Lightapp and Pepsico discovered the VSD compressor, the most efficient unit to run for partial loads, was running only about 2% of the time, with the larger base compressor inefficiently supplying the varying load.

A very useful feature of the Lightapp solution is the ability to compare monitored facilities against each other. The data (Figure 3) clearly showed that Pepsico Fresno was an outlier in terms of system efficiency and plant pressure. Typical system efficiency in the group averaged 22 kW per 100 cfm. The data also showed a high level of system leakage during non-production times.

"Based on the data we ended up changing the compressor settings, at no cost, and got the compressors to work in a more efficient way," said Ben Duncan, Pepsico Fresno Production Manager. "Technicians from Lightapp came to the plant to help us and the monitoring system showed the results of our efforts."

As shown (Figure 4), the improvement after the adjustment resulted in a better specific power of 40 kW per 100 cfm, lower than previous, but still in the high range. The software is reporting a 30% increase in efficiency over the base case. Future plans are to better address compressor control, lower system pressure and reduce compressed air leakage. In addition, the company is considering vibration analysis and monitoring

Figure 4: The system specific power has been improved with some simple control system adjustments (Source Lightapp)

of their chiller systems using the same software. Duncan was so impressed with the system he has recommended it to the company's Sacramento and Buena Park plants.

Baked Goods Plant

At the Bimbo Bakeries plant in Montebello, Calif., the study showed how the Lightapp solution led to more energy-efficient and effective use of compressed air and more.

Plant Engineer Matthew Davis reports Lightapp was installed in April 2017 and it took a few months for the study to capture the necessary baseline information, before being turned over to the plant. Parameters measured on the 2 x 200 hp and 2 x 100 hp system are compressed air flow, pressure, compressor power and energy consumption.

The system was initially measured at a specific power of about 40 kW per 100 cfm, but is now running at a level of 28 kW per 100 due to a few adjustments made to the compressor order of priority and some load reductions. Davis said the initial analysis of the data showed two large 200 hp compressors always running in their plant, but with each fighting for control. When one was loaded the other would unload. Based on this, adjustments were made and one of the large compressors was shut down with a smaller 100 hp taking its place. Plans are to install a compressor control system to improve system efficiency.

"The information from Lightapp showed that we were using more energy than we should, and the flow profile showed we were having large spikes in our air flow at certain times of the day," said Davis. "We found that during shift changes our operators were all using compressed air blowing at the same time to clean our bread pans. This caused our compressor operators to start another compressor, and leave it running, ruining our system efficiency."

Subsequently, the plant rescheduled the blowing so that it could be done over a longer period of time, lowing the peak. Low-pressure blowers are being installed to remove the need for any 100 psi compressed air to be used at all, with the expected reduction to be 800 cfm, about 200 hp worth of air compressor capacity.

The monitoring system also showed problems with the flour bin dust collectors, which have diaphragm operated blasters that reverse pulse using compressed air to clear dust from bag filter elements. Due to the hot environment in California, the rubber diaphragm material degrades at an accelerated rate over time, causing valve failure that can consume large amounts of compressed air. Future plans are to place flow meters on the main feed to these devices and set up system alarms to signal if failure occurs.

Conclusion

As many companies have found over the years, simply monitoring and analyzing the data from compressed air systems can reveal all sorts of hidden challenges, many of which can be improved by low-cost/no-cost measures. These profiled plants are prime examples of the varied problems and solutions that can improve the efficiency of compressed air systems, and other systems in industrial plants, all as a result of a focus on collecting and analyzing system data. The Lightapp software appears to be one of the best at gathering this data and presenting it in a form that is easy for system operators to understand and use to track system KPI's and make any necessary improvements. BP

For more information contact Ron Marshall, Marshall Compressed Air Consulting, tel: 204-806-2085, email: ronm@mts.net

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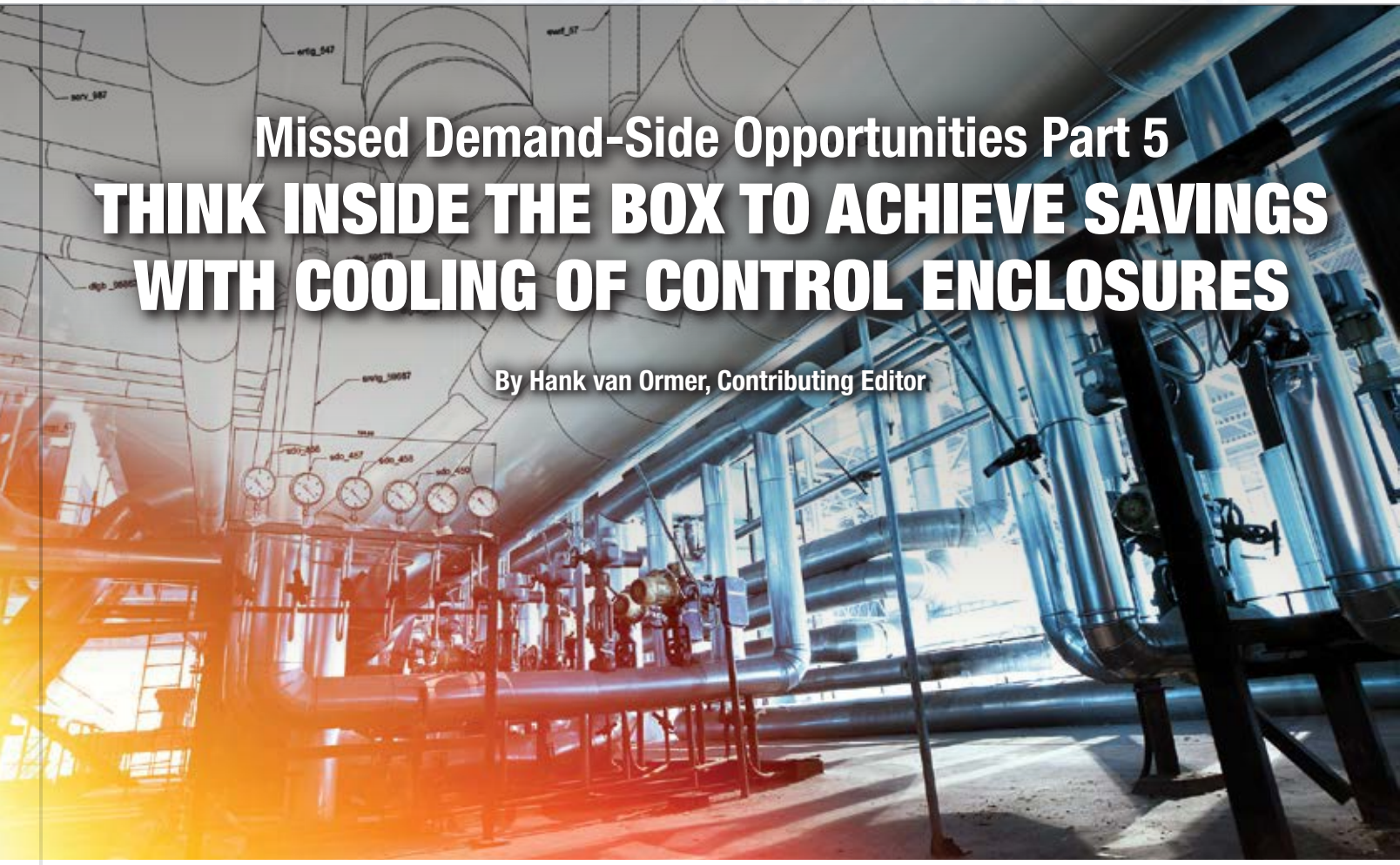


Missed Demand-Side Opportunities Part 5

THINK INSIDE THE BOX TO ACHIEVE SAVINGS WITH COOLING OF CONTROL ENCLOSURES

By Hank van Ormer, Contributing Editor

➤ In this ongoing column, we share insights into technologies that offer the opportunity to affordably and easily lower compressed air use and generate energy savings – all while achieving relatively quick payback.

But finding these technologies on the production floor isn't always easy or straightforward. In fact, there are many times when a technological solution is far less than obvious. Such is the case with cooling of control enclosures, which represent a significant area for high-energy savings with little upfront investment. Here is some out-of-the-box thinking… check that… inside-the-box thinking… for optimizing control of enclosure cooling and coming out ahead.

Compressed Air and Control Enclosure Cooling Go Together

You may be asking what does control enclosure cooling have to do with compressed air, but they do in fact go together.

One of the most effective methods of control enclosure cooling, particularly in very harsh conditions, is with compressed air-driven products. However, when applied without any sort of regulation, this can be the least economical type of enclosure cooling. And remember: Control enclosure cooling, when needed, is important since it can extend the life of critical electronic equipment and reduce maintenance and downtime.

When utilizing a control enclosure, most equipment designers select the enclosure size and resultant cooling area with regard to normal internal heat rejection, basing this

"Demand-side opportunities can appear elusive but they often exist in places that require a closer look."

— Hank van Ormer, Contributing Editor

selection on a maximum internal temperature target of 90 ˚F. Basic industrial equipment is usually designed to operate in 100 ˚F or lower ambient, unless otherwise stated.

Enclosure coolers often come into the operating plant already installed on production machinery, such as presses, formers, packaging units, etc. Plant personnel often are not aware of the selection parameters since the cooler is perceived as "part of the package" from the OEM.

However, it's easy to overlook the fact that many applications in ambient areas with temperatures over 90 ˚F for sustained periods may well require auxiliary enclosure cooling, particularly if the equipment is older.

The key question is whether the facility needs enclosure cooling. Yet the answer dictates the need to take step back and ask important questions:

1. What is the internal temperature when operating under all appropriate conditions? The enclosure itself is effectively a heat sink; it will transfer inside-generated heat to a cooler surrounding area, or it will transfer heat from a hot surrounding area into the enclosure. On the other hand, if the surrounding area is air-conditioned with a normal 70 ˚F temperature, the heat sink effect of the enclosure may be all the cooling needed.
2. Is the enclosure is located in a very hot area? If it is, determine whether it's practical to move the control enclosure to a cooler location.
3. Is the enclosure using compressed air to hold inside positive pressure to prevent the intake of outside contaminants? If yes, there are enclosure-cooling devices, such as air-driven Vortex units, that will cool and vent the internal enclosure while it is completely sealed.
4. Is there room around the enclosure and sufficient airflow to deliver stable air temperature year round?

If the operation determines it needs auxiliary control enclosure cooling after factoring in these considerations, plant personnel can determine what type and what size unit best fits the plant's needs with minimum operating energy and maintenance cost.

Evaluating Commercial Control Enclosure Coolers

Commercial control enclosure cooling comes in six basic types: Fan (blowing filtered ambient air); compressed air open blow (at ambient temperature); refrigeration (Freon-based); refrigeration (heat tube); thermoelectric refrigeration (400-1,500 Btu/hr. range); and compressed air driven vortex tube refrigeration.

Here are insights into available choices to aid in decision-making:

Fan with Ambient Air: Internally Mounted, Drawing in Filtered Air

If the ambient air temperature surrounding the enclosure is more than 90 ˚F, cooling the inside of the enclosure below 90 ˚F is unrealistic with this technology.

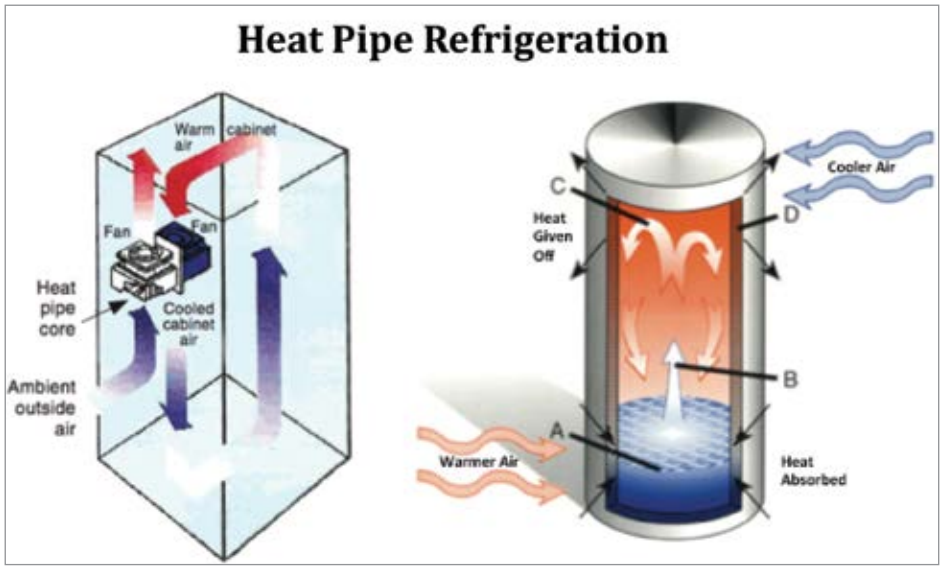
This type of cooling depends on "exchanging the air" and requires a certain amount of cooler air coming in and hotter air going

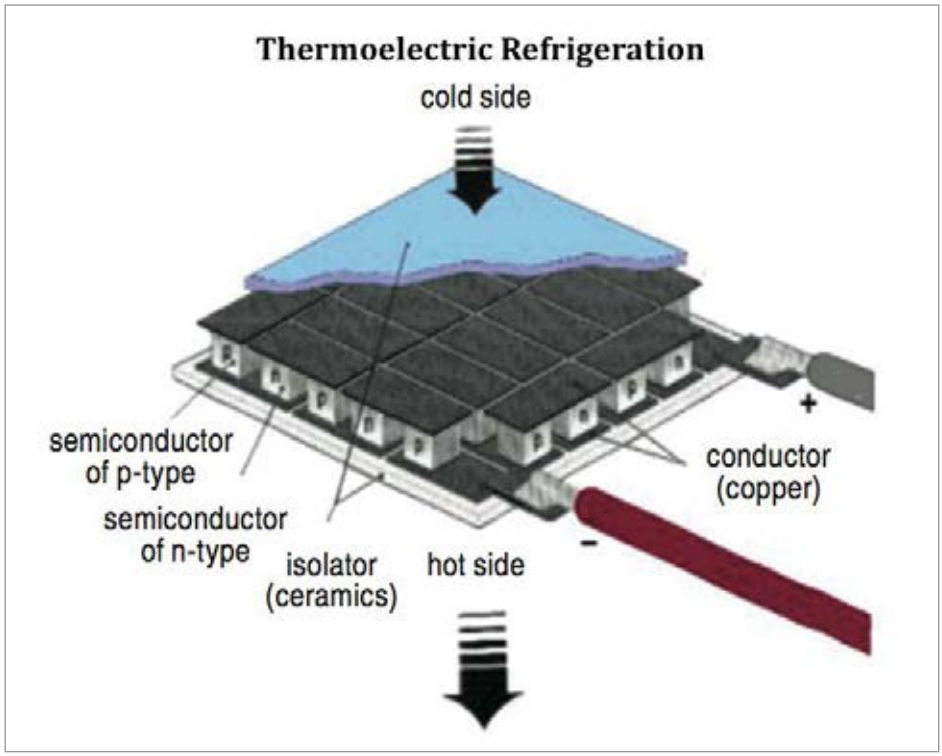
MISSED DEMAND-SIDE OPPORTUNITIES PART 5

out to handle the Btu/hr. load. It is limited in application since it will only work with "cooler" ambient air. Although very low energy users, they work best when operating conditions will allow proper performance and the conditions are stable.

Compressed Air Blowing Directly into the Enclosure

Assuming compressed air being blown is also at ambient temperature, it will not deliver much better performance than the fan-driven ambient air cooler option except for increased density. Overall, it is very expensive to produce compressed air. In addition, unless this air is dry and filtered, it can carry oil, water, and contaminants into the electronic controls. We do not recommend this practice.





Freon-based Refrigeration Units

Freon-based refrigeration units can lower the ambient air temperature about 15 ˚F to 16 ˚F each pass. For more cooling drop, the refrigeration action is cumulative as long as there is enough capacity. This usually limits their usage to ambient temperatures no higher than about 125 ˚F for optimum performance.

The refrigeration usually mounts on the side of the enclosure and continues to cool the same air inside the enclosure over and over until the desired internal temperature is reached. The units usually run at a constant speed, but when there is enough refrigeration capacity, these units may be controlled to shut off with a temperature switch. In practice, they often run most of the time – particularly if a hot gas bypass valve is controlling them. There is no electrical energy savings in the hot gas bypass valve (HGBV) control model.

Heat Pipe or Heat Tube Refrigeration

A heat pipe consists of a sealed metal tube whose inner surfaces contain capillary wicking material. Inside the container is a liquid (alcohol or similar) under its own pressure that enters the pores of the capillary material, wetting all internal surfaces. Applying heat at any point along the surface of the heat pipes causes the liquid at that point to boil and enter a vapor state. When that happens, the gas picks up the latent heat of vaporization. The gas then has a higher pressure, and moves inside the sealed tube to a colder location where it condenses. Thus, the latent heat of vaporization moves heat from the input to the output end of the pipe. This process takes place at high speed.

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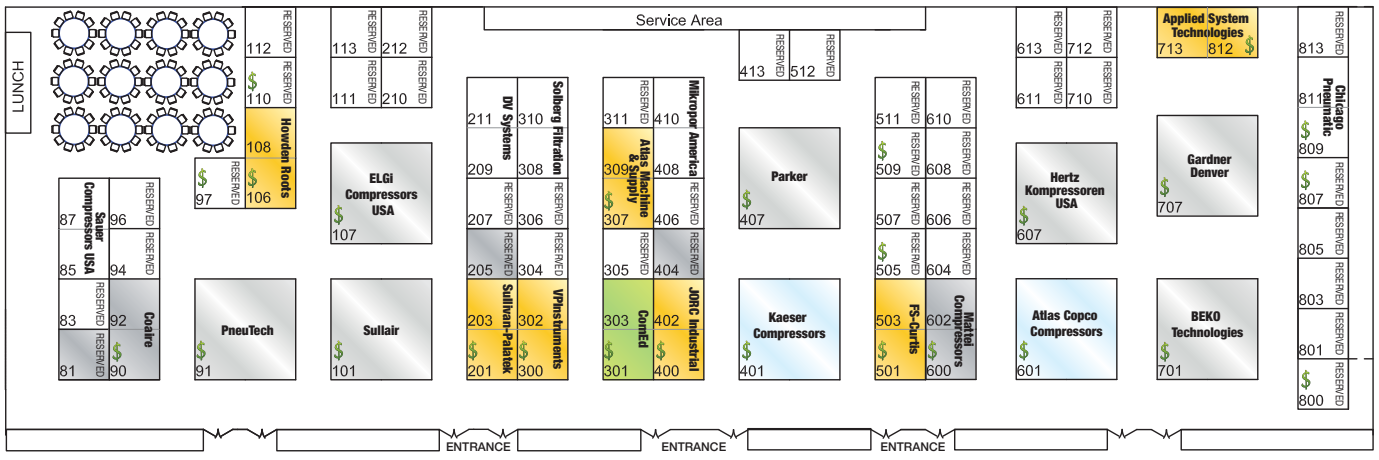

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The core materials selected for use in the heat tube enclosure coolers are typically copper tubing and aluminum fins.

The fans are normally axial type and designed to be an easily changed replacement part.

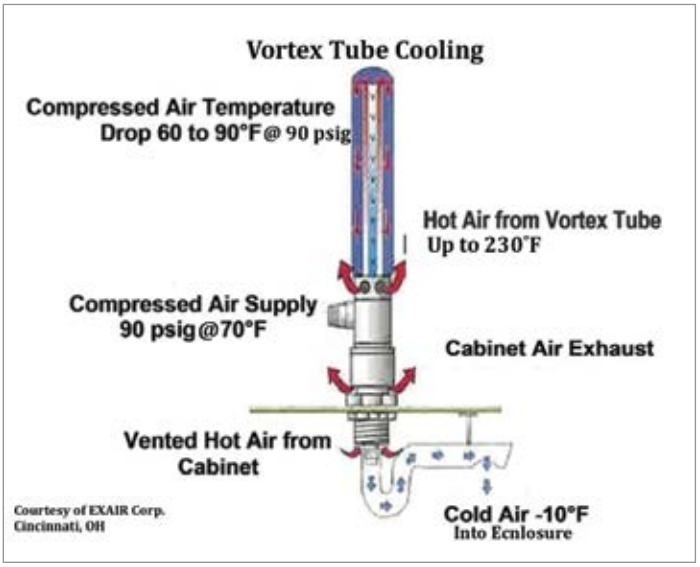
The lowest electrical energy cost for refrigerated control enclosure cooler is often the heat pipe. Air-cooled units can only cool to almost ambient temperature. When the ambient temperature around the box is higher than the desired inside temperature, they will not work.

When ambient temperatures are too high to allow air-to-air heat refrigeration, water-cooled versions are available. Like the air-to-air units, the air-to-water units are flush mounted and have no exposed fans or fins to protect. They offer below ambient cooling and even lower electrical energy use per Btu/hr. than air-to-air units. They require available cooling water inside the sealing tubes at 50-60 psig and about 1-2 gpm. These use most sources of process or cooling water, while not significantly raising the process water temperature.

These units perform very well and no water enters the enclosure to harm any electronics. Air-cooled units are limited to about 3,500 Btu/hr. heat loads. Water- cooled units go up to about 60,000 Btu/hr.

Thermoelectric Refrigeration

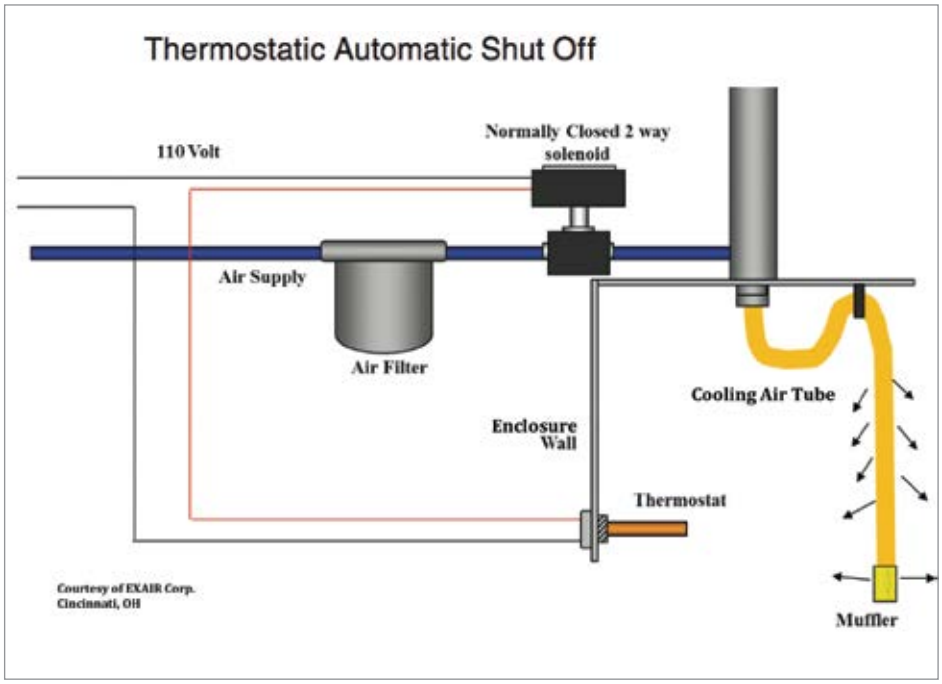
An older technology now emerging into the commercial industrial control enclosure cooling market is "thermoelectric refrigeration." It was first developed and applied to internal cooling of computers and other electronic components. Thermoelectric plates utilize the Peltier cooling design. As current to the plate is reduced, the cooling effect



is reduced. The control system modulates the amount of current to maintain a target temperature.

The energy cost to operate a thermoelectric refrigeration control enclosure cooler is from 50% to 80% less than Freon refrigeration units. This technology does not always have the capability to develop the higher temperature differential of some other solutions, particularly vortex tube cooling.

Thermoelectric refrigeration is usually available in units from 1,500 to 3,000 Btu/hr. cooling in a single unit. It will handle many of today's smaller enclosure cooling jobs in the industrial environment. It will cool below ambient air temperature, but is limited to a cooling temperature differential of (10˚F to 20˚F) below ambient.



Refrigeration – Vortex Tube Cooling

Vortex tubes generate chilled air without the use of refrigerant or any moving parts.

As compressed air flows through the tube and vortex generator, hot air blows out of one end and cold air out of the other.

The vortex flow generator is an interchangeable, stationary part. It regulates the volume of compressed air.

Everything else being equal, as the inlet pressure rises, the cold air temperature drops (within performance limits). A compressed air temperature drop of up to 90 ˚F is available at about 90psig inlet pressure in many models.

Lower inlet air pressure or backpressure on the cold end will reduce pressure ratios across the tube and raise the cooling air temperature. There is usually a relief valve in the vortex tube cooler assembly venting the enclosure air, allowing backpressure to not build up, and exchange hot air for cold air.

MISSED DEMAND-SIDE OPPORTUNITIES PART 5

Since well-applied vortex tubes cool quickly and have no moving parts, they can shut on and off as often as required to save airflow.

Vortex tube coolers should always be controlled by a thermostat sensing the inside enclosure air and an electric solenoid to shut the air on and off with the signal.

Vortex Tube Refrigeration coolers are least affected by high ambient temperature with regard to performance and operating life.

When applied in such areas as "wash-down"; high dust; and corrosive elements, etc. they require a sealed enclosure and a positive internal pressure. Most manufacturers offer a built in bypass in the control solenoid. This allows a small amount of compressed air to flow into the enclosure when the Vortex Tube Cooler is off.

Summary

- Filtered fan air and open blowing of system compressed air are often not the proper selection for ensuring optimal performance and operating cost.
- The lowest energy cost refrigeration – when it can be applied correctly – is the HEAT PIPE-air-cooled units that can only cool to almost ambient temperature. When the ambient temperature around the box is higher than the desired inside temperature, the application will call for water-cooled units, which are also very energy efficient but do require a source of cooling water.
- Thermoelectric refrigeration units are still relatively small in cooling capacity and limited to about a maximum of 20 ˚F temperature reduction below ambient.
- Vortex tube coolers are the most versatile coolers due to the fact that they can hardly be misapplied as far as cooling. They can definitely be misapplied as far as inefficiency and wasting compressed air – your most expensive utility. Always install vortex tube coolers with properly selected automatic temperature controls to maintain energy efficiency.
- Vortex tube coolers can generate significant temperature drop. The higher the pressure, the lower the temperature within the design limits.
- A vortex tube cooler works well in any refrigeration application. With little to no maintenance and infinite life compared to Freon refrigeration, it is always a safe selection.

These innocuous control enclosure coolers, attached like a growth on production machinery, will often offer a significant opportunity for energy reduction and probable productivity improvement when optimized.

Case Study: Automotive Plant

At the plant, a review showed that a compressed air system comprised of twenty 6,000 Btu/hr. Freon-type Refrigeration Control Enclosure coolers were not working and were scheduled for replacement. Instead, the plant chose to replace them with twenty 6,000 Btu/hr. air-to-air HEAT PIPE units.

Cost savings

- The heat pipe units used .140kw for a total of 2.8kw. The annual energy cost for the units totaled $1,472.00 (2.5kw x .06kwh x 8760hrs).
- The Freon Refrigerated units that were replaced were rated at an average 2.0kw each for a total of 40kw. The annual energy cost was $21,024 (40kw x .06kwh x 8760hrs).
- Total annual savings = $19,552.

Payback

- The installation cost for twenty heat pipe units was approximately $16,000, resulting in a simple payback in less than 10 months.

Case Study: Aluminum Rolling/Mill

This Aluminum Mill had 5000 Btu/hr. Freon Refrigeration coolers mounted above the furnaces. These were failing several times a year due to the high operating ambient temperature of 140 ˚F to 150 ˚F.

The mill replaced the units with Vortex Tube Refrigerated Coolers rated at 80+ scfm demand. The new enclosures for the units, which deliver automatic temperature control, were well insulated.

Cost savings

The Vortex Tube Refrigerated Coolers operated for two years without with an annual average flow of 25.8 scfm (about 4.75kw). As such, it saved $2,386 in annual electric energy cost (4.75kw x 0.6 x 8760 hrs).

Conclusion

Demand-side opportunities can appear elusive but they often exist in places that require a closer look. This doesn't make "one technology better than the other." The key is to understand and apply the proper technology to the application. BP

We hope you've found this interesting and look forward to your comments! Contact Hank van Ormer, email: hankvanormer@aol.com, tel: 614.580.2711

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Compressed Air Quality Specifications & Compliance

Using ISO 8573.1 to Specify Safe Quality Food (SQF) Compliant Compressed Air
Chair: Phil Kruger, Vice President, Harris Equipment

Testing, Monitoring & Documenting Procedures for Compressed Air Quality
Ruby Ochoa, President, Trace Analytics

Auditing Against the Compressed Air Requirement
LeAnn Chuboff, Vice President of Technical Affairs, SQFI

Compressed Air Quality Monitoring Including Dewpoint and Oil Vapor Content
Joe Fecko, Midwest Regional Sales Manager, BEKO Technologies

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New BOGE Low Pressure Turbo 150

Consistently reduced operating costs on the low pressure network – with the new Low Pressure Turbo 150, BOGE promises the best efficiency values at an operating pressure up to 4 bar. In contrast with oil-free screw compressors, low pressure turbo technology stands out due to its excellent characteristics, compact design and quiet running. With 100 per cent oil-free compressed air, the compressor is particularly suitable for sensitive areas of use such as glass production, fish farming and the chemical industry. Combined with the continuous improvement programme service option, the machine remains constantly state-of-the-art. BOGE is thereby setting new standards for ongoing energy-efficient supply in the low pressure sector.

Manufacturing glass packaging, operating fish farms and cleaning production lines for metal processing require large amounts of compressed air up to 4 bar. With the Low Pressure Turbo 150, BOGE enables operators of low pressure networks to reduce their running costs. The optimum technical coordination of permanent magnet motor, air-guided drive shaft and two-stage compressor system is setting new standards with regard to efficiency in the low pressure field. A frequency converter adapts the compressor to the compressed air requirement accordingly. The entire drive mechanism works without a single drop of oil. Oil-free class 0 compressed air is therefore produced. The technology is particularly wear-free and low-maintenance – there is no requirement for regular oil and filter changes. With its compact design, the Low Pressure Turbo 150 requires less space than comparable screw compressors. Turbo technology is also considerably quieter than oil-free screw compressors.

The new BOGE Low Pressure Turbo 150

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With the BOGE continuous improvement programme (CIP) the compressed air specialist offers users of the Low Pressure Turbo 150 highly efficient production in terms of energy at all times. The family-run company based in Bielefeld analyses the machine data in use by the customer and identifies energy-saving potential. On this basis, BOGE continuously develops turbo technology hardware and software that is functionally relevant individually to the customer. Cost-intensive maintenance thereby becomes a thing of the past – the performance of the Low Pressure Turbo 150 is continuously improved. There is no requirement for investment in product optimization. The customer and BOGE share the energy savings instead. The result: decreasing operating costs and production that is highly-efficient in terms of energy at all times.

More information on the BOGE LPT 150 is available at us.boge.com/en-us/lpt.

About BOGE Compressors

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Within the Dollinger portfolio are the highly efficient LL-142 liquid filters. Designed to remove final traces of dirt, pipe scale and other solids from process liquids, these innovative units use a radial fin element design to maximize the effective filtration area and minimize pressure drop across the filter. The large filtration area, which is up to 10 times bigger than equivalent tubular type cartridge filters, also increases the dirt holding capacity of the filter to extend service life and reduce maintenance costs. The unit further optimizes uptime with rapid maintenance through the use of a single filtration element within the unit, which can usually be cleaned and re-used. For particularly demanding applications, stainless steel mesh media can additionally be incorporated into the element design.

SPX FLOW Dollinger LL-142 Liquid Filters

The LL-142 filter can be customized to match specific process needs and is available with up to 200 different filtering media and a selection of construction materials to handle process and installation conditions. The filtration basket has a standard collapse pressure of 1.5 to 3.45 bar, with high pressures available if required. The housing is designed and constructed as standard in accordance with ASME VIII, Division 1 Pressure Vessel construction code with design to other codes also available as required.

Also within the Dollinger range, oil mist eliminators offer exceptional performance with capture of oil droplets and particles down to 0.3 micron. This efficient removal of oil mists keeps the surrounding environment and equipment cleaner and so easier to maintain, preventing the formation of dangerous and slippery surrounding work areas.

Once installed and running, the SPX FLOW Dollinger oil mist eliminator requires minimum maintenance with a filter element life of up to five years. The unit further increases economical operation by enabling more efficient maintenance of surrounding machinery and by capturing the escaping oil and recirculating it into the lube tank, to reduce turbine and compressor oil consumption.

All of SPX FLOW Dollinger filtration solutions are designed for efficiency, exceptional performance and reliability, to reduce the total cost of ownership and protect valuable machinery. They are designed for optimal performance with advanced engineering capability to meet even the most exacting of installation and application requirements and are supported throughout their lifetime with leading engineering and aftermarket services.

About SPX FLOW, Inc.:

Based in Charlotte, North Carolina, SPX FLOW, Inc. (NYSE: FLOW) innovates with customers to help feed and enhance the world by designing, delivering and servicing high value solutions at the heart of growing and sustaining our diverse communities. The company's product offering is concentrated in rotating, actuating and hydraulic technologies, as well as automated process systems, into food and beverage, industrial and power and energy markets. SPX FLOW has approximately $2 billion in annual revenues with operations in more than 30 countries and sales in more than 150 countries. To learn more about SPX FLOW, please visit www.spxflow.com.

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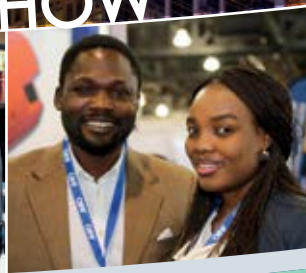

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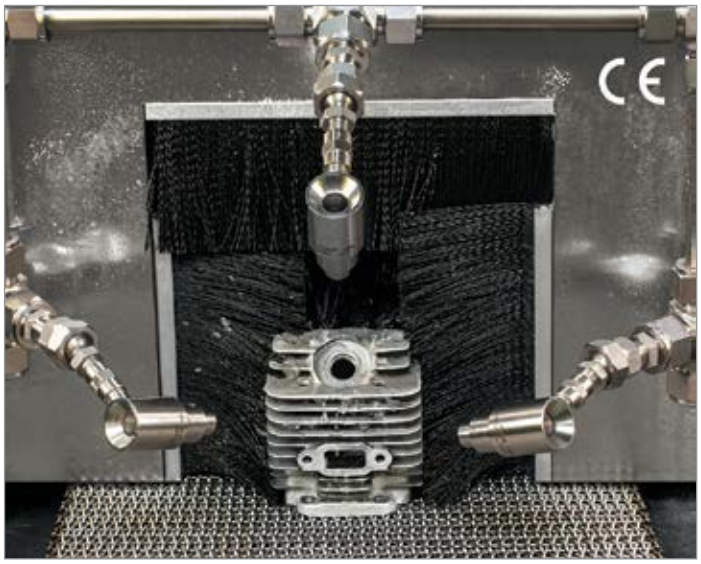

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Sierra Instruments Announces New Big-3 Flow Measurement Solutions

Sierra Instruments announced their new flow energy solutions for optimizing and measuring nearly every critical and costly flow found in the chemical industry.

The Big-3 features Sierra's QuadraTherm 640i/780i thermal flow meters, their InnovaMass 240i/241i vortex flow meters, and their new InnovaSonic 207i ultrasonic flow meter. Designed, built, and calibrated in the USA by Sierra, the Big-3™ share the same revolutionary Raptor firmware and many of the same software apps. They are a complete flow energy solution for flows like compressed air, natural gas, steam, and hot and chilled water. Together, they set a new standard in ease-of-purchase, performance, accuracy, reliability, and ease of use.

"In chemical plants, there are a wide variety of flow energy applications that require measurement," says Matthew Olin, President of Sierra. "Engineers often must contend with an assortment of companies to obtain the right instrumentation. With the Big-3, we've eliminated many of the overwhelming challenges they face. They now have the option of acquiring all necessary flow meters from one company, saving time and money on installation and maintenance. And one contact point links them to Sierra's global network of flow energy experts for all of their support requirements."

The Big-3 share common firmware and software for easy integration, set up, and serviceability, enabling operators to leverage their knowledge between the different platforms. All patented Big-3 (thermal, vortex, and ultrasonic) sensors provide unparalleled accuracy, extensive flow knowledge through multivariable functionality, and benefit from the Raptor operating system to manage sensor inputs.

QuadraTherm iSeries thermal sensors offer a no-drift sensor with a lifetime warranty and accuracy of +/-0.5% of reading. QuadraTherm's four sensor technology provides the critical inputs for Raptor's living, learning algorithm set and gas database to accurately manage changes in gas and pipe selection, gas temperature, gas pressure, and outside temperature.

InnovaMass vortex sensors combined with the Raptor OS offer a patented Mass Balance sensor, improved DSP, and achieve flows below 1 fps. The InnovaMass iSeries measures up to five process variables with one process connection: volumetric flow rate, mass flow, density,

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pressure, and temperature, which is ideal for highly accurate steam flow measurement.

The InnovaSonic 207i ultrasonic flow meter ensures accuracy of +/-0.5% of reading from 0.16 to 40 ft/s (0.05 to 12 m/s). This is maintained even if liquid density changes as the temperature of a flowing liquid moves up and down over time. Sensors are designed for temperature compensation to ensure correct speed of sound for increased accuracy and ease of installation.

Raptor, the Big-3's shared firmware system, is a fluid, dynamic algorithm set that has hyper-fast microprocessors, delivers digital communication protocols, provides field flexibility, and enables software apps. For QuadraTherm (thermal), Raptor calculates out unwanted heat transfer to provide precise mass flow rate. QuadraTherm also comes with on board qMix gas mixing software, which allows engineers to create custom gas mixtures in the field to compensate for gas compositional changes without recalibration costs and loss of accuracy. With InnovaMass (vortex), Raptor reduces external vibration with proprietary noise reduction algorithms to enhance the signal-to-noise ratio. Raptor firmware also gives InnovMass iSeries the ability to measure much lower flow velocities (near 0.5 fps) than equivalent vortex meters in the industry. In the InnovaSonic (ultrasonic) flow meter, Raptor, with its temperature input, adjusts fluid density calculation in real-time to maintain accuracy. Most ultrasonic metes assume a fixed temperature and thus lose accuracy.

In addition, the Big-3 has shared software apps with common home screens. With the Big-3 there is no learning curve on three different software platforms. Big-3 software apps gives Plant Engineers and Managers the ability to mine and analyze data quickly to make effective productivity decisions. Software apps include ValidCal Diagnostics for field calibration validation, Datalogging, MeterTuning to automatically cancel external noise to improve accuracy, Dial-A-Pipe to change pipe size in the field, and Dial-A-Fluid to change fluid type in the field without loss of accuracy.

The accuracy of the Big-3 is backed up with world-class calibration. Flow meters are only as good as their calibrations, and Sierra has invested millions in its state-of-the-art, fully automated, gas and liquid calibration facilities to assure consistent accuracy and repeatability of its flow meters. Sierra is ISO certified and follows ISO17025 guidelines.

Contact Rod Smith for ad rates: **rod@airbestpractices.com, Tel: 412-980-9901**

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All Big-3 flow meters come with a NIST traceable and fully ISO 17025 compliant Cal cert.

All three flow meters that make up the Big-3 are designed, built, and calibrated in the USA – A first for any USA company. Commissioning to set up the Big 3 is also available through Sierra's global network of flow energy experts.

About Sierra

A global leader in flow measurement and control for over 40 years, Sierra Instruments designs and manufactures fluid flow measurement and control solutions for customers spanning global industries as diverse as scientific research, oil & gas, energy management, semiconductor, clean energy, aerospace, and biotech, to name a few. **In everything we do, we challenge the status quo to continually push our technologies and solutions to the next level to do the "never before possible" for customers.** With over 150 locations in over 50 countries, Sierra is uniquely positioned to provide innovative products and lifetime support for the leading companies of today and the growth enterprises of tomorrow.

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