The Magazine for ENERGY EFFICIENCY in Compressed Air Systems

COMPRESSED AIR BEST PRACTICES

airbestpractices.com

June 2017

Compressed Air System Assessments

SUSTAINABLE MANUFACTURING FEATURES

COLUMNS

FROM THE EDITOR | Compressed Air System Assessments

Compressed air leaks defy efficiency efforts every day in our plants. When the government says it wants to regulate air compressor efficiency, hoping to gain a couple percentage points, I immediately think about the average leak rate of 20 percent in each plant. Warwick Rampley provides us with a very practical and hands-on article titled, "Having a Go at a Leakage Survey"? It's loaded with very practical advice on fixing leaks-rather than detecting them.

Our second article provides end users with a snapshot of some compressed air system key performance indicators and diagrams one should have-before making investments or changes. Don van Ormer, from Air Power USA, has provided us with a snapshot of the "before" situation they provide to their customers during a system assessment. If end users would ask their suppliers to provide them this information, in an on-going manner, they would find higher efficiency and reliability levels.

Variable frequency drive air compressors have made a significant contribution to the improved efficiencies of compressed air systems. Questions persist about when one should (and should not) use VFD air compressors. Tim Dugan, from Compression Engineering Corporation, has volunteered to start a series of articles addressing this question. His first article targets smaller plants and he provides us with his opinion on which load and plant conditions are favorable for the use of a single VFD air compressor.

Parrheim Foods was considering the purchase of a new air compressor until they asked for a system assessment. I hope you enjoy Ron Marshall's article on how addressing issues with a compressed air dryer and a major end user (the bag houses) helped the company turn OFF an air compressor instead. Lastly, I hope you enjoy our Show Report on the 2017 Hannover Messe.

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

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INDUSTRY NEWS

German Chancellor Angela Merkel Praises Smart Air

As part of her tour marking the opening of this year's Hannover Messe, German Chancellor Angela Merkel and Polish Prime Minister Beata Szydlo paid a visit to Kaeser Kompressoren's trade show booth. Naturally, Kaeser was delighted to welcome Chancellor Merkel and Prime Minister Szydlo. For her part, the Chancellor was enthusiastic about the power of innovation demonstrated by the Coburg-based compressed air system provider.

German Chancellor Angela Merkel praised the Industrie 4.0 products and services offered by Kaeser as "very nice" while Thomas Kaeser, Chairman of the Board at Kaeser Kompressoren, explained these to her in just a few minutes. In her speech opening this year's Hannover Messe on Sunday, the Chancellor had expressed concern that although there are currently many concepts related to Industrie 4.0, at this point relatively few concrete products and services are actually available. Thomas Kaeser emphasized that Kaeser is different in this regard, mentioning how as a compressed air system provider, Kaeser already offers innovative Industrie 4.0 products and services, and is showcasing them at Hannover Messe. Merkel showed great interest in the company's background and history, asking about the company's size and number of employees, and praising the family company.

In conclusion and as a token of thanks, the Kaeser Board presented the Chancellor with a model of a compressor, which she then wanted to "have explained" by her staff.

When it comes to keeping production rolling, industrial manufacturing plants require compressed air as much as electricity: it's simply indispensable and has to be available, otherwise production grinds to a halt. It is therefore vital to remain abreast of current developments in compressed air production technology – especially when it comes to solutions for enhancing the reliability and maximizing the cost-effectiveness of the compressed air supply. And thanks to its latest digitization strategy, this is precisely what Kaeser does. Thomas Kaeser explained to the two top-level politicians just how Kaeser does it. The company's "Smart Air" concept encompasses innovative, networked compressors with "digital twins" in the form of intelligent controllers, real-time data transfer and monitoring, as well as valuable access to

Kaeser's world of expertise. All of these recent developments enable Kaeser to track the "health status" of a compressed air system at all times, which means the company can initiate predictive maintenance before a problem occurs. Moreover, digital system management ensures optimized compressed air costs and sufficient compressed air supply at all times.

About Kaeser: Kaeser 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 www.kaesernews.com. For more information or to be connected with your local authorized Kaeser representative, please call (877) 417-3527.

Right to left: German Chancellor Angela Merkel and the Prime Minister of Poland, Beata Szydlo, listen as Thomas Kaeser, Chairman of the Board at Kaeser Kompressoren, presents the latest innovations in the field of compressed air technology (left of Thomas Kaeser are Alexander Jan Kaeser and Tina-Maria Vlantoussi-Kaeser).

INDUSTRY NEWS

Hitachi Acquires Sullair for $1.245 Billion

Hitachi, Ltd. (TSE:6501, "Hitachi") and Accudyne Industries (CEO:Charles Treadway; "Accudyne") announced that the two companies have entered into an agreement regarding Hitachi's acquisition of Accudyne's subsidiaries and certain related assets that manufacture and sell air compressors under the "Sullair" brand (Sullair (President: John (Jack) Carlson)).

In order to become the "Innovation Partner for the IoT Era" by accelerating collaborative creation with customers through the advanced Social Innovation Business, Hitachi has introduced a market-in business structure composed of "front", "platform", and "products" in April 2016. Hitachi's "front" business has strived to work side by side with its customers to create new value through the rapid and effective utilization of its Social Innovation Business by leveraging digital technology, with the "Lumada" IoT platform at its core.

Hitachi's goal in this acquisition is to gain access to Sullair's global sales network, mainly in North America. Furthermore, Hitachi will accelerate the global rollout of the Social Innovation Business, by providing Sullair's customer base with digital solutions or IoT-compatible products that leverage the expertise in IT and OT (operational technology) which Hitachi has cultivated over many years.

As for the product business, in an effort to establish a strong product business that meets a broad range of industrial needs, Hitachi has been developing the product business through the unified strengths of the Industrial Products Business Unit (CEO: Masakazu Aoki), which integrated Hitachi's industrial product business in May 2015, and Hitachi Industrial Equipment Systems Co., Ltd. (President: Yutaka Araya; "HIES"), which handles small or medium sized industrial products. Air compressors in particular have been positioned as a core business, in which Hitachi provides high-quality, high- efficiency products mainly in Japan and Asia. Hitachi plans to add its products to Sullair's highly complementary product lineup, and utilize the global sales network Sullair has established, mainly in North America, and increase the scale of the air compressor business.

Since its foundation in 1965, Sullair has been selling its very reliable air compressor products on a global scale. Sullair has established a strong sales network and customer base especially in North America. Accudyne has selected Hitachi as the best partner to ensure long-term success of Sullair given its sales network in Japan and Asia as well as the complementary relationship. Integration into Hitachi will secure a bright future for Sullair and its employees.

Masakazu Aoki, Executive Vice President at Hitachi and CEO of the Industrial Products Business Unit, said: "I am very pleased to announce that Hitachi has today agreed with Accudyne to proceed with the acquisition of Sullair, a leader in the air compressor business. Through this fusion with Sullair's strengths, Hitachi will increase its competitiveness and strengthen the air compressor business, and at the same time, by utilizing Sullair's global footprint, mainly in North America, we will accelerate the global rollout of the Social Innovation Business."

Charles Treadway, CEO of Accudyne, said, "We are very pleased with the transaction,

as the combination represents a uniquely attractive opportunity for Sullair, its employees, distributor partners and end-customers."

Jack Carlson, Sullair President, said, "We are thrilled by the prospect of partnering with Hitachi to grow Sullair as we embark together on the next chapter in our proud history."

The agreed purchase price of Sullair is US$1.245 billion (approx. JPY135.7 billion). It is subject to certain customary adjustments at effective date of the transaction (for example, for fluctuations in Sullair's net working capital and net debt).

www.hitachi.com

Kobe Steel Opens 40 MW Compressor Test Facility

Kobe Steel, Ltd.'s Machinery Business has opened a 40 MW test facility for large-capacity nonstandard compressors at its Takasago Works in western Japan. Construction of the 8 billion yen facility began in February 2015.

The new facility was completed in early April 2017 on schedule and an opening ceremony was held. About 120 people participated in the event, including Executive Vice President Mitsugu Yamaguchi, head of the Machinery Business, and Senior Managing Executive Officer Takao Ohama, who is in charge of the Compressor Division.

Executive Vice President Mitsugu Yamaguchi gives a speech at the opening ceremony.

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Kobe Steel's 40 MW compressor test facility is designed to meet the growing need for large-capacity compressors in the world market.

Nonstandard compressors are used widely range to compress process gas and for reaction application in petroleum refineries, chemical plants, power plants, steelworks and other facilities. Compressors are essential for plant operation. In recent years, as plants have grown larger and require increased production and higher efficiency, demand has been growing for large-capacity compressors with motor outputs of 30 to 40 MW, mainly centrifugal compressors. In addition, customers have been seeking to source large-capacity compressors from the Japanese and Asian markets.

Kobe Steel had completed product development of large-capacity compressors in the 40 MW class, but lacked a test facility to conduct performance tests at the final stage. To meet this need, Kobe Steel constructed a large test facility that has twice the capacity of its current 20 MW test facility. The new test facility, one of the largest in the world, is capable of handling nonstandard compressors with variable-speed motors of 40 MW. The new facility now enables Kobe Steel to satisfy conditions to enter the large-capacity compressor market.

Participants at the opening ceremony view a large-capacity compressor ready to undergo testing.

One of the themes of Kobe Steel's medium-term management plan is to expand its compressor business. The use of the new test facility will contribute to further increasing sales. The compressor business currently generates annual sales of 80 to 90 billion yen. In fiscal 2020, Kobe Steel aims to achieve sales of 130 billion yen.

Types of compressors	Compression method
Centrifugal	Uses the centrifugal force from impellers. Comes in two types: integrally geared and single shaft. Kobe Steel excels at integrally geared compressors. As the optimum number of revolutions of the impellers can be controlled, this type of compressor is noted for its high efficiency.
Screw	Uses two helical rotors for compression
Reciprocating	Uses the reciprocating action from a piston to compress gas in a cylinder

For more information, visit http://www.kobelco.co.jp/english/

$1 Million in Donations for Atlas Copco USA's Water for All

Atlas Copco USA's employee-run program Water for All has surpassed $1 million in donations. The milestone comes after making a $50,000 contribution to charity: water, a New York-based nonprofit organization dedicated to funding water projects across the globe.

"With the $1 million we've donated, we've been able to positively impact over 40,000 people spread over four different continents," said Jim Levitt, President of Atlas Copco North America. "Reaching this outstanding milestone reflects our associates exemplary dedication to this cause."

Founded in 1984 by two Atlas Copco employees in Sweden, Water for All is worldwide program that provides safe drinking water to areas in need. Today, Water for All is represented in 35 countries, and over 5,000 Atlas Copco employees contribute annually. Levitt attributes the program's success not only to ongoing employee commitment, but also

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to Atlas Copco's matching policy; for every employee dollar donated to Water for All, Atlas Copco contributes $2.

The donation will help charity: water carry out its mission of working with local communities to determine the most effective method to provide clean, sanitary water. Water for All's donation will fund a drill-bored well for a community in North Tigray, Ethiopia. On average, each charity: water well in Ethiopia can serve 250 to 300 people.

"We're proud to support charity: water," Levitt said. "One hundred percent of donations go directly to funding water projects, making them a great partner in global sustainability.

"This is a fantastic achievement, but it's just the beginning," Levitt continued. "We're continuing to grow our program and increase our support to communities in need. We've already made a big impact and will continue to do so into the future."

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 and gas 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

Festo Names New Distributors

Festo named Wolf Solutions, BG Technologies and AWC as new distributors. Festo named Wolf Solutions to distribute automation products in Oklahoma and Texas. Festo named BG Technologies in Austin to distribute sensors and power supply products in Texas. Festo named AWC to distribute process automation products in Alabama, Florida, Georgia, Louisiana, Mississippi, Oklahoma, Tennessee, and Texas. Festo is one of the world's leading suppliers of pneumatic and electric motion actuation components and subassemblies.

Wolf Solutions, a Service Disabled Veteran Owned Small Business in Krum, TX, has been in business three years. The company offers customers extensive industrial automation and project management experience by employees dedicated to providing customer service. "Wolf Solutions is a distributor of a wide variety of automation parts and solutions," said Dustin Greene, President. "We work together with customers and high quality suppliers such as Festo to make our customers efficient and profitable."

Founded in 2002, BG Technologies is a small woman-owned industrial electronic distributor with a staff that offers over 130 years of combined industrial electronic experience. "As a true family business, some of our employees are family members and all have worked closely enough that we feel like family," said Linda Gibson, President. "This has come to include our customers, vendors, and partners. With products from high quality suppliers such as Festo, BG Technologies gives each customer our best service and support, just as we would for our family."

AWC offers customers a team of more than 400 engineers, technical support and service specialists across 30 local customer care centers, located mainly in the southern U.S. "AWC's motto **'Winning Together'** is our commitment to proactively provide the right information, products and assistance to our customers," said Bob Wenyon, President and CEO. "Working together with our trusted technology partners, such as Festo, enables us to keep that promise."

For more information on Festo, call 800-993-3786 and visit http://www.festo.us. Wolf Solutions can be reached at 866-552-6405 and https://www.wolf-solutions.us. . BG Technologies can be reached at 512-336-2299 and http://www.bg-technologies.com/. AWC can be reached at 800-364-0292 and http://www.awc-inc.com.

About Festo

Festo is a leading manufacturer of pneumatic and electromechanical systems, components, and controls for process and industrial automation. For more than 40 years, 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.

Connect with Festo: Facebook, LinkedIn, Twitter and YouTube

For more information, contact us at www.festo.us or by calling 800-993-3786.

John Henry Foster Employees Support Missouri Communities

John Henry Foster held a food and clothing drive to benefit the St. Patrick Center- one of Missouri's largest providers of housing, employment and health opportunities for people who are homeless or are at risk of becoming homeless. Seeing a need for building permanent, positive change in local communities, employee-owners at the St. Louis based company decided to step in and help out.

Receiving over 5000 items from John Henry Foster employees, such as clothing, food, diapers and small appliances, a representative from St. Patrick Center had this to say, "We are very grateful for John Henry Foster's donations to support those who are homeless or at risk of becoming homeless. Clothing, food, household items, hygiene and personal care items, and the other items you collected help us meet the basic needs of clients while they work to obtain housing, employment, and assistance with their mental and physical health."

John Henry Foster is the Midwest's leading sales and service provider of industrial automation and process control instrumentation. Specializing in pneumatics, hydraulics, compressed air and electronic controls, JHF designs and manufactures efficient solutions for even the most complex industrial applications.

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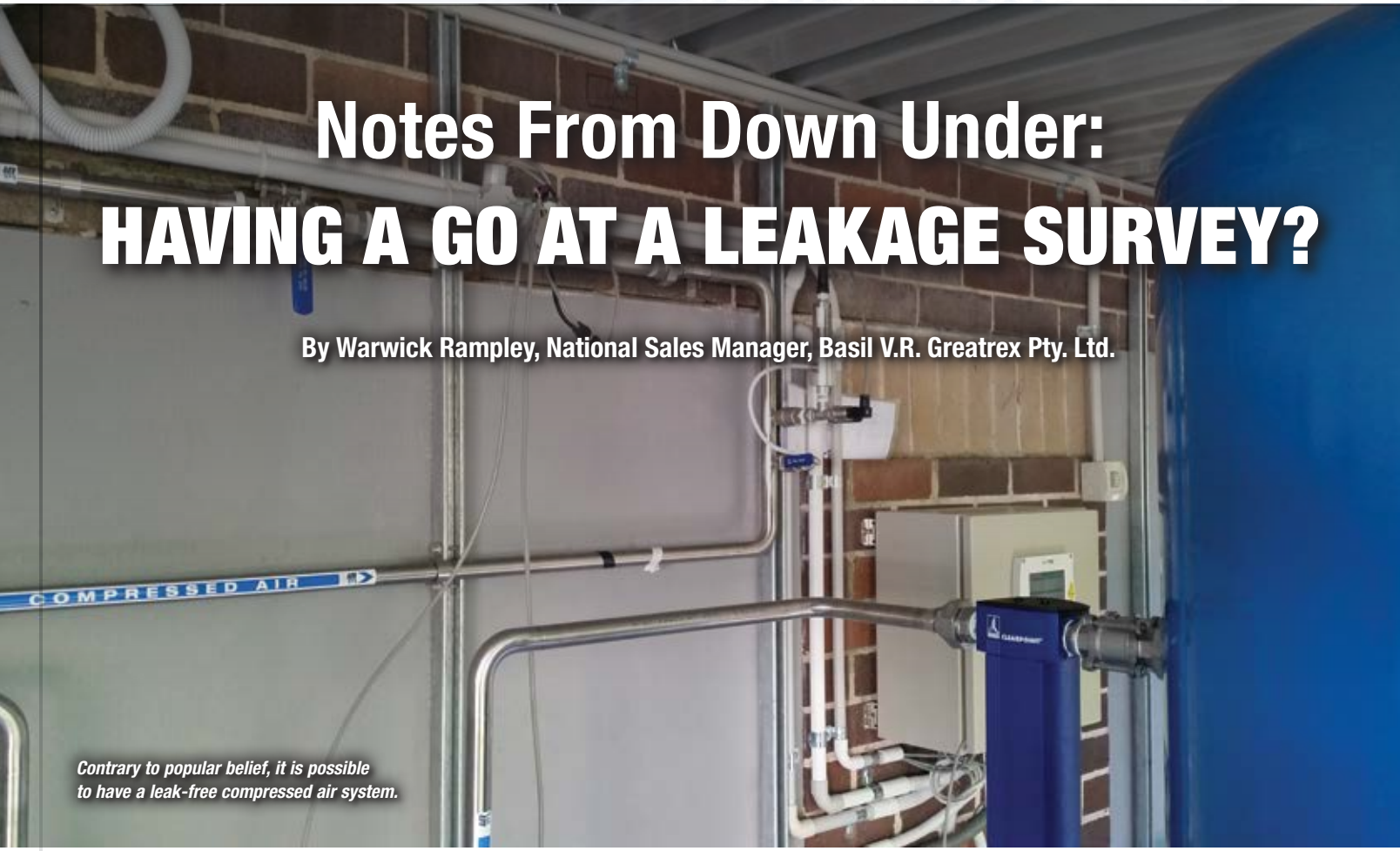
Notes From Down Under: HAVING A GO AT A LEAKAGE SURVEY?

By Warwick Rampley, National Sales Manager, Basil V.R. Greatrex Pty. Ltd.



Contrary to popular belief, it is possible to have a leak-free compressed air system.

So you've purchased an ultrasonic leak detector after a sales person gave you a demonstration on detecting compressed air leaks. You've read all those articles on how air leaks are wasteful, expensive and leakage programs provide good paybacks. Perhaps you've even had a go at a leakage survey. Either way, by now you've realized leakage programs are not as simple as they sound and without an ongoing plan of attack, you will probably never see the results you thought you could achieve. This article is written to illuminate common mistakes made in leak surveys and hopes to provide guidance on how to turn that around.

Start with the Repair Plan

Probably the most critical mistake I find is that everyone thinks leakage surveys starts with detecting the leaks. Any two-bit fool with a spray bottle and some soapy water can detect leaks. Now that you own an ultrasonic leak detector, this will be faster and less messy, won't it? But leakage doesn't start with detection, leakage starts with the plan for repairs, after all, if you aren't going to do the repairs why are you even thinking about doing the leakage survey? To start with, who is going to do the repairs? When is the best time to make the repairs? How long is it going to take? What parts will you need? How long will it take to get them?

"Probably the most critical mistake I find is that everyone thinks leakage surveys starts with detecting the leaks."

— Warwick Rampley, National Sales Manager, Basil V.R. Greatrex Pty Ltd.

When and Who and What?

I would usually aim for a planned shutdown, ideally one where the compressed air can be turned off across the whole site for around 12 hours or more. Of course this takes some coordination, but it can be achieved. The best ones are those where the power will be off across the site. This means you're going to need some torches and lights. Working back from that date you want to allow at least six to eight weeks prior to completing the survey, to organise the parts and book the labour. I can almost guarantee you that using one or two technicians isn't going to cut it for the repairs.

Now that you know when the survey needs to be completed by, who's going to do it?

One machine can have several leaks.

NOTES FROM DOWN UNDER: HAVING A GO AT A LEAKAGE SURVEY?

You have a detector, so you can always do it in-house, but have you ever really tried? Do you have everything you actually need? And what's worse is the poor individual that's going to do the detection is pretty much going to listen to varying levels of static for as many days as it's going to take to do the survey.

In short, it's a horrible job and your technicians may be better utilized on routine maintenance! You are going to need a tag of some form for each leak, a way to record the details for each leak, how big the leak is, what parts are required to fix the leak, whether the leak can be isolated or repaired during production periods, how long will it take to fix it, the list goes on and on.

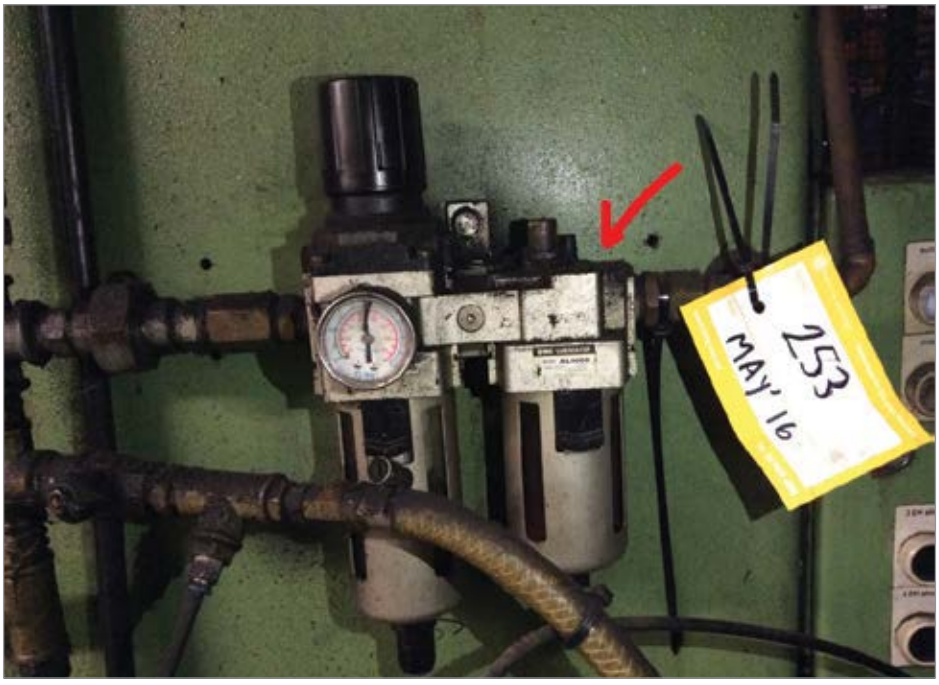
A very large notepad might work, but when you try and consolidate everything you wrote down, it will be a disaster. Best off to get someone in that specializes in leakage surveys. The minimum reports you will want to see come out of it will be:

- A full list of the leaks with an estimated flow and cost (more about this shortly)
- Details on each leak, its location and a couple of photos to help locate the leak later
- A list of parts required for each leak
- An estimate on the amount of time required to repair each leak

After the Survey – Ordering Parts

By the time a leakage survey is completed you should have all the information you need to complete the repairs. Let's order some parts…

For your own sanity, stick to like for like parts, if it's an XYZ regulator, replace it with an XYZ regulator. Otherwise you are going to be drilling new mounting holes and creating a whole lot of extra work for yourself. There will be enough superseded items on your list to keep anyone entertained, so don't make it worse. That does



Leaks are commonly found where older FRL's are located.

mean you might need to place 10 or 15 small orders to different suppliers - but it's worth it. You'll also be wanting to double check the part you are ordering comes with all the extra bits. For example, some regulators don't come with a gauge or mounting brackets, some solenoids don't come with the face-mounting gasket…etc.

Inevitably on your list will be a long series of push fits, hoses and clamps required for simple quick fixes. You know you keep that sort of thing in stock, so you should be good to go. More than likely what you think is a good level of stock will be everything you don't need and this will bring your entire plan unstuck right at the first gate. You need to buy in all the parts on your list and some extras, I've seen one site go through more than a hundred ¼" x ¼" straight push fits on a single survey. You must order everything!

Once the parts start to arrive, you'll want to sort and bag them by each leak. You're going to need space to do this… but each set of parts should be bagged and tagged to match each leak, that way when the repairs happen the technician can toddle off with a bunch of assigned leaks, all the parts, their tools and some fresh thread sealant! Don't forget the THREAD SEALANT! Make sure every technician has at least one fresh tube and you have some spares because someone is going to lose one in the factory somewhere.

NOTES FROM DOWN UNDER: HAVING A GO AT A LEAKAGE SURVEY?

The Big Repair Day: Target 80-90% of Leaks Repaired to Make a Difference

And now the big day is finally here. By now you are wondering could I have done the repairs in bits and pieces and to some extent the answer is yes, but the reality is they never get completed, other problems take priority and you never see a notable change to the system.

Here we go… time to shut the system down. Did you remember that it takes time for the pressure to drop? You'll want to shut the system down at least an hour before the technicians are due to start, assign leaks on a per machine basis to each technician or ten at a time if there are only a few on each machine. Let the technicians head off with everything they need and when they return have them confirm each leak that was repaired.

If by some chance they were unable to repair something, make sure all the explicit details are documented so you can come back to it

another day. It is best to get as many leaks repaired as possible rather than focus on why one particular leak can't be done. You need to get greater than 80% of the leaks repaired to have any real effect and preferably more than 90%. That includes all the tiny little ones, they have plans to grow and they are going to grow a lot quicker than you expect.

What Happens When Your Repressurize the System?

By the time the repair day is over, everyone will want to go home, but you need to stick around and let the system come back up to pressure. Typically the system pressure will come up around 7-10 psi, after a big repair day, but that means some extra stress on all those components that up until now have had it easy.

Typically several regulator, filter and drip leg drains, along with a few hoses and push fits are going to fail within the first hour. Sometimes these can be so big that it will negate anything you and your armada of technicians just finished doing. The best thing you can do, while everyone is still there, is to send them out into the factory and do their best to repair anything they can hear that failed or document what is needed to fix the problem. Once these repairs have been completed, sometimes over the next week, then and only then might you see a result.

But how will you ever know if you aren't monitoring your system correctly? BP

For more information, contact Warwick Rampley, National Sales Manager, Basil V.R. Greatrex, at email: warwick.rampley@bvrg.com.au or visit www.bvrg.com.au

To read more about ***Compressed Air Leak Surveys,*** please visit www.airbestpractices.com/system-assessments/leaks

Analysis of Current Air Compressors and Dryers IN A SYSTEM ASSESSMENT

By Don van Ormer, Air Power USA

A complete compressed air system assessment should provide detailed information on both the supply and demand sides of the system. The supply-side refers to the equipment supplying compressed air – the air compressor, dryers, filters, piping and storage tanks. The purpose of this article is to illustrate what information we believe a factory should receive from a supply-side system assessment and more importantly – what information a plant should always know about their compressed air system. To illustrate this, and due to article space constraints, we will provide examples of the information we believe end users should receive on their air compressor and air dryers. To provide examples, we will use commentary and tables we generated, quite some years ago, during a compressed air system assessment at a chemical plant in the Midwest.

Key Performance Indicator Averages

We recommend putting the averages of all the Key Performance Indicators together into one table – and tracking them. These include system flow (scfm), air compressor discharge pressure (psig), system pressure (psig), input electric power (kW), operating hours of the air system (hrs), specific power (scfm per kW), electric cost per year for compressed air in dollars per unit of flow ($ per cfm per year), and finally the annual electric cost for compressed air ($ per year).

TABLE 1. KEY AIR SYSTEM CHARACTERISTICS – CURRENT SYSTEM*

MEASURE	ALL SHIFTS	BUILDING 236
Average System Flow	2,307 scfm	211 scfm
Average Compressor Discharge Pressure	103 psig	103 psig
Average System Pressure	101 psig	95 psig
Input Electric Power	571 kW	59 kW
Operating Hours of Air System	8,600 hrs	8,600 hrs
Specific Power	4.04 scfm/kW	3.57 scfm/kW
Electric Cost for Air /Unit of Flow	$127.72 /cfm yr	$144.28 /cfm yr
Annual Electric Cost for Compressed Air	$294,636 /year	$30,444 /year
	$325,080 /year	

*Based upon on a blended electric rate of $0.06 per kWh and 8,600 hours/year.

Air Compressor Use Profile and Observations

The system assessment should provide detailed information on the air compressor use profile. In this manner, one can assess if the air compressors are working with or against one another. One can also assess if the air compressors are working within their "sweet spots" – the load percentages where they operate efficiently and reliably. During how many shifts are the air compressors working? What is the rated full-load kW consumption and air flow (scfm) delivery capacity of each air compressor? Compare actual kW demand and air flow as a percentage of full load. In this case, we had two physical areas to analyze; the main plant and "building ZR3B2".

Example: The system is currently operating with both Centac units at 100% base load most of the time with the Kobelco running in trim mode. The "Case AirLogix" controller appears to be running well. The Centac 2-stage units have very limited effective turndown (20%+) and also are relatively inefficient compared to today's more modern units.

The pipe size and velocity of air in pipes is not causing problems with the ability to control units to allow the air supply system to match air flow of demand. The new 5" header and piping changes made, as described in Air Power USA's 2002 report, are working well and both Centac units can fully "load in" with no restrictions.

The Kobelco is a load/no load or on-line/off-line control, which is either full load or no load. It is currently difficult to set it up in the same system with the plant centrifugals because the load/no load controls need an operating control band to work. The Centac units use a set point and throttle range. This means that the load/no load machine will back down the Centac units unless the set point is below their operating range. A regulator was installed in the line coming from the Kobelco receiver to correct this situation. However, during the site visit, we noticed that as the Kobelco moved up its operating band (100-107 psig), the system pressure moved up similarly, including the discharge pressure at the Centac units. Thus, the centrifugals are still backing down some, even though the controllers are showing full flow. Centrifugal flow will always fall somewhat depending on the performance profile as it sees higher discharge pressure.

These two 2-stage centrifugals are well maintained, but are significantly less power efficient and reliable than a modern 3-stage unit when well applied. The Kobelco appears to be operating very well and it is an excellent unit and also appears to be well maintained.

Diagram of Current Compressed Air System

As time goes by in most plants, compressed air systems can become a hodge-podge of different models and brands of air compressors, dryers, filters and receiver tanks. Rental air compressors can be included in the mix to assist with demand spikes. The piping systems can become a bewildering mix of sizes and materials (and leaks). We strongly suggest some kind of visualization tool from a simple block diagram to a nicer graphic representation of the supply-side of the system.

Individual Reliability Analysis of Each Air Compressor

Air compressors are durable and long-lasting machines which will outlast most employees when they are properly maintained. A good

ANALYSIS OF CURRENT AIR COMPRESSORS AND DRYERS IN A SYSTEM ASSESSMENT

TABLE 2. COMPRESSOR USE PROFILE – CURRENT SYSTEM

UNIT #	COMPRESSOR: MANUFACTURER/ MODEL	FULL LOAD		ACTUAL ELEC DEMAND		ACTUAL AIR FLOW	
		DEMAND (KW)	AIR FLOW (SCFM)	% OF FULL KW	ACTUAL KW	% OF FULL FLOW	ACTUAL SCFM
All Shifts: Operating at 101 psig discharge pressure for 8,600 hours							
1	Centac 1CM2 EAST	259	1175	0.93	242	0.88	1034
2	Centac 1CM2 WEST	241	1069	0.93	225	0.88	941
3	Kobelco KNW2	158	554	0.66	104	0.6	332
			TOTAL (Actual):	**571 kW**		**2,307 scfm**	
Building 236: Operating at 110 psig discharge pressure and 8,600 hours							
1	ZR3B2	117	554	0.5	59	0.38	211
			TOTAL (Actual):	**59 kW**		**221 scfm**	

system assessment will work with maintenance and review the service records of the air compressors. In this case, the air compressors had all been operating for 15+ years. Below is an example of some of the observations made. We provide the client with an examination of voltage, amps, motor power factor and kW consumption of each air compressor – during each of the three productions shifts.

Example: Today's compressed air system consists of two Ingersoll-Rand Centac model C10M2, one Kobelco model KNW2, 200-hp class, lubricant-free rotary screw compressor, and, one Atlas Copco model ZR200 lubricant-free rotary screw compressor which is out of service and not part of the current operating air system.

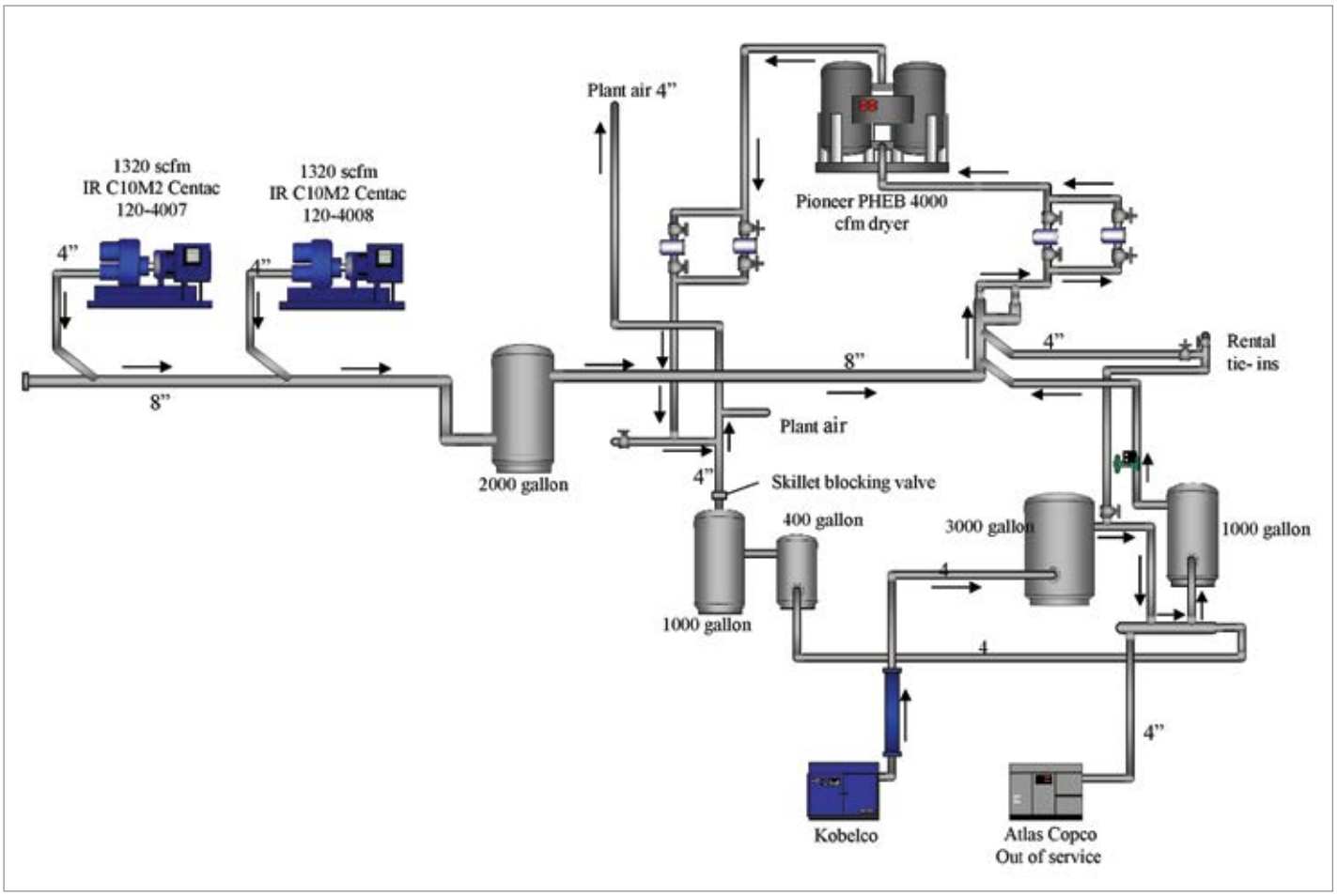


Figure 1: Current Compressed Air System Diagram

The Ingersoll-Rand Centac compressors had some problems in the past with motors and mother control boards in addition to other components. The West Ingersoll-Rand Centac has a 350-hp motor and the East Ingersoll-Rand Centac has a 400-hp motor. The motors were overhauled in 1994 and 1995 respectively. These units were rated for 1,037 cfm and new, equipped with throttled inlet with by-pass, and auto dual control, which will let the unit fully unload and idle. The current piping and effective storage will not allow the dual control to work. Both compressors are running base air load.

Plant personnel believe that when the Centac units were overhauled in 1994/1995, wheels were replaced with 1,500-cfm rated wheels. The compressors are delivering approximately 1,320 scfm each and draw 270 average kW when running full load. The East Compressor was drawing 242 average kW. The units have 20-25 % turndown. Total air flows are measured with a Sierra heated-wire, thermal-mass flow meter. Data is real time and trended with one point every 10 seconds. Flows reflect data observed over several days and several times per shift.

The units had the wheels and diffusers cleaned and reset but no modification in 2004 or 2010 according to Air Relief service records. The East unit in 2004 and the west in 2010 the blow off air was directed to the compressor inlet which depending on conditions can cause premature internal part deterioration. The units are still running with this piping. If the units are going to operated significantly in the future this should be checked with the OEM.

During the August 2011 audit site visit, the following electrical data readings were taken. Both units were operating at 101-102 psig and had the IBV 100% open and the BOV 100% closed.

Compressed Air Dryer Use Profile and Observations

Compressed air quality (in terms of moisture, oil and particulate removal) is critical to the reliability of production equipment. Compressed air dryers, filters, drains are always an important part of a system assessment. Are they functioning properly, are the technologies

TABLE 3: COMPRESSED AIR DRYERS – CURRENT SYSTEM

MANUFACTURER	PIONEER	DONALDSON ULTRA FILTER
Model	PHE4000	AR-1200
Unit Type	Blower Purge	Refrigerated Non-cycling
*Rated Flow @ 100ºF / 100 psig / 100 scfm 200	4000	1200
Purge air scfm 15%/ ¼ Time	150 scfm	N/A
Full Load Heater kW (or Refrigerated kW) Average	120 kW X .75 = 90 kW	
Full Load Blower kW	17.5 kW	N/A
Total Full Load kW	107.5	6.5
% Load w/ Dew Point Demand Control or Cycling Regeneration	100%	100%
Net Electric Demand (kW) Average	107.5 kW	6.5 kW
Total Annual Operating Cost ($)	$55,470 yr.	$3,354 yr.

* Based upon a blended electric rate of $0.06 per kWh and operation of 8,600 hours per year.

COMPRESSED AIR

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ANALYSIS OF CURRENT AIR COMPRESSORS AND DRYERS IN A SYSTEM ASSESSMENT

out-dated? In the case below, we recommended the dryer be replaced with a much more energy efficient Heat-of-Compression dryer.

Example: The plant's current dryer is a 4,000-scfm rated Pioneer blower purge dryer with 17-kW motor drive blower and 120-kW heater. The dryer is equipped with a dew point demand controller to shut off the blower air during the cooling cycle to avoid the pressure dew point spike and thermal bumps.

At the time of our visit in 2002 and also 2011 (August) the dew point demand control was off and the pressure dew point was -40˚F or better according to the central meter. This is somewhat suspect.

Operating Data 16 August 2011- 8:30 AM – 10:30 AM. The dryer was running default heatless mode (300 scfm purge air) from Monday through 2:50 pm Wednesday, August 17, 2011.

- Control Board alarm on
- Left tower drying & heating/ 78˚F / 95 psig
- Right tower regenerating 75˚F / 10-12 psig
- Blower off
- Heater off
- Unit defaults to heatless 300-scfm
- Compressed air purging continually (has the same tower for over 48 hours)

Currently the plant is running a Pioneer 4,000 scfm maximum rated, blower purge desiccant dryer with a 5-psig drop. This dryer is working well; however, this unit has dew point demand control which could save an estimated $20,000-22,000 per year if activated and working. The dew point demand controller is not activated. The exhaust muffler also needs to be replaced.

The plant may also wish to consider replacing the standard filters with high performance, deep-bed, loose-packed filters to extend and reduce pressure drop.

This is a relatively old dryer with obsolete valving (switching valves that leak and will continue to do so unless overhauled). At this time, the dryer is running continuously in heatless mode with the blower off and the heaters off probably using 300 scfm of compressed air according to plant personnel. The readjusted purge pressure was measured as performing on the plant data systems to –40˚F or better. At 2:50 pm on August 17, 2011, the dryer was reset to normal operation and the purge also shut off. The Kobelco compressor went from 85% load (timed cycle – 471 scfm) to 40% load (timed cycle – 221 scfm). This situation would put the purge rate at a minimum of 250 scfm. Considering the dynamics of the air system, we agree the plant's number of 300 scfm as the purge volume.

Conclusion

We hope these tables and figures can provide end users with a feel for what information they should know about their current air compressors and dryers. Ideally they will own a compressed air management system able to provide them with this data in real-time. If not and they engage the services of a firm to conduct a supply-side compressed air system assessment, this is a part of the information they should receive – before beginning conversations about how to improve the system. BP

For more information, contact Don van Ormer, Air Power USA, at don@airpowerusainc.com or visit www.airpowerusainc.com.

To read more about ***Compressed Air System Assessments*** please visit www.airbestpractices.com/system-assessments

Sizing VFD Air Compressors for SINGLE-COMPRESSOR SYSTEMS

By Tim Dugan, P.E. President, Compression Engineering Corporation

➤ Introduction

As an end user, have you ever heard the message to put in the biggest VFD air compressor, and the system will always be reliable and efficient. Why do an audit? Just add up the compressors on site and put one VFD for that size or larger. Why have the complexity of multiple compressors, storage, sequencing, etc? Even better, put in two of them, one for the whole system, and one for back-up. If you could wave a wand, wouldn't that be what every system should look like? Perfect peace and efficiency, with 100% confidence of reliability.

Readers who have been involved in the utility rebate/incentive business, as a program manager, evaluator or auditor, know that these types of decisions have been encouraged by rebates, and that many systems are not operating in the mode that they were supposed to, or are not operating at all due to reliability problems.

Most of my audits have been on "large", complex systems, systems with over 500 hp total installed air compressors, with multiple types and compressor rooms. What about the "normal" systems that outnumber the ones

> "I recommend using a single VFD air compressor (with backup) when demand levels are known and the compressor is sized so demand varies between 30% and 80% of compressor maximum."
>
> — Tim Dugan, P.E. President, Compression Engineering Corporation

I look at 10:1? The ones with one compressor room, and less than 100 hp installed? Isn't it appropriate to have one VFD compressor running the system, with a full-sized back-up? And if so, how should you size the compressor?

In this article, I aim to answer the question with a qualified "yes". Yes, there are many systems where this can occur. I will describe where you only need one, and in those cases, how to size that one compressor.

Summary

In a nutshell, I recommend using a single VFD compressor (with backup) when:

1. Demand levels are known and the compressor is sized so demand varies between 30% and 80% of compressor maximum.
2. Demand profile doesn't sit at low end often.
3. No major changes in usage are anticipated in the next 10 years.
4. The system is currently centralized and likely to stay that way.
5. You can afford a full-sized backup.

Demand Varies Between 30 – 80%

How do you know your demand, to get the compressor sized to be in the "sweet spot"? Some say do an "audit". I think that's great if you want to pay a guy like me $3k to $10k, and get just one picture of demand and need the consulting advice that comes with it. Or you can get one "free" from the vendors helping you size that one VFD compressor. That's fine if their audit "black box" accurately calculates flow.

The reason I say the demand shouldn't vary below 30% of peak is that most VFD compressors' efficiency starts to drop off at

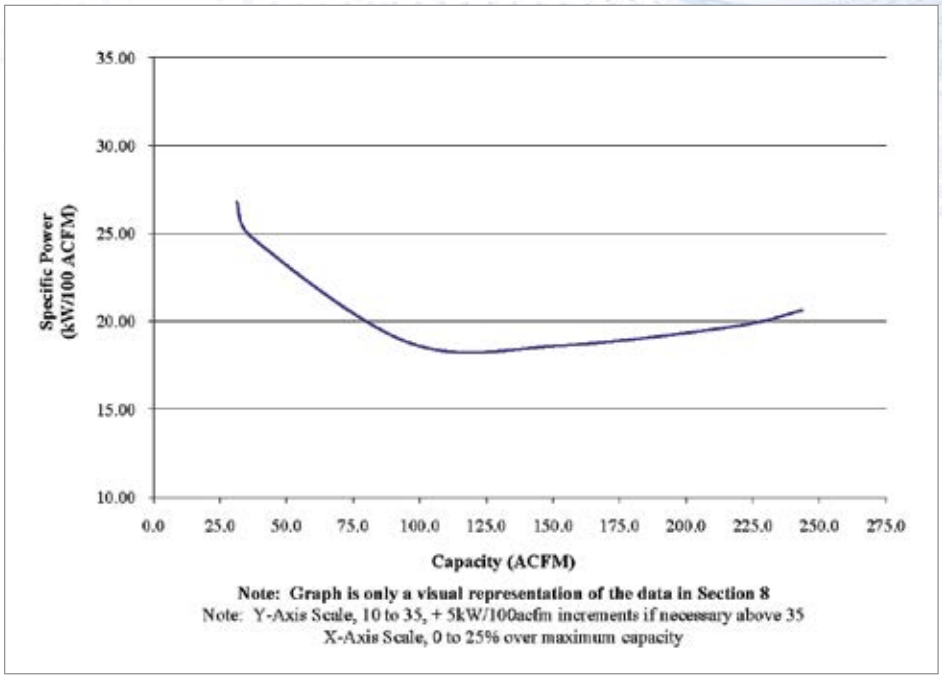

Figure 1. A typical performance curve for a 50 hp VFD air compressor from a CAGI Data Sheet.

SIZING VFD AIR COMPRESSORS FOR SINGLE-COMPRESSOR SYSTEMS

50% speed, and gets worse as you hit the minimum speed. In addition, the compressor oil will not run warm enough if at minimum speed for lengthy periods, causing reliability problems. Interestingly, the motor is an exception. It runs hottest at the lowest speed. That's because it is a constant torque application, plus slippage making it even higher torque at low speed, and the motor cooling is diminished significantly at low speed. If you clamp a CT on the motor winding current, you can see that the winding current actually rises at lower speeds.

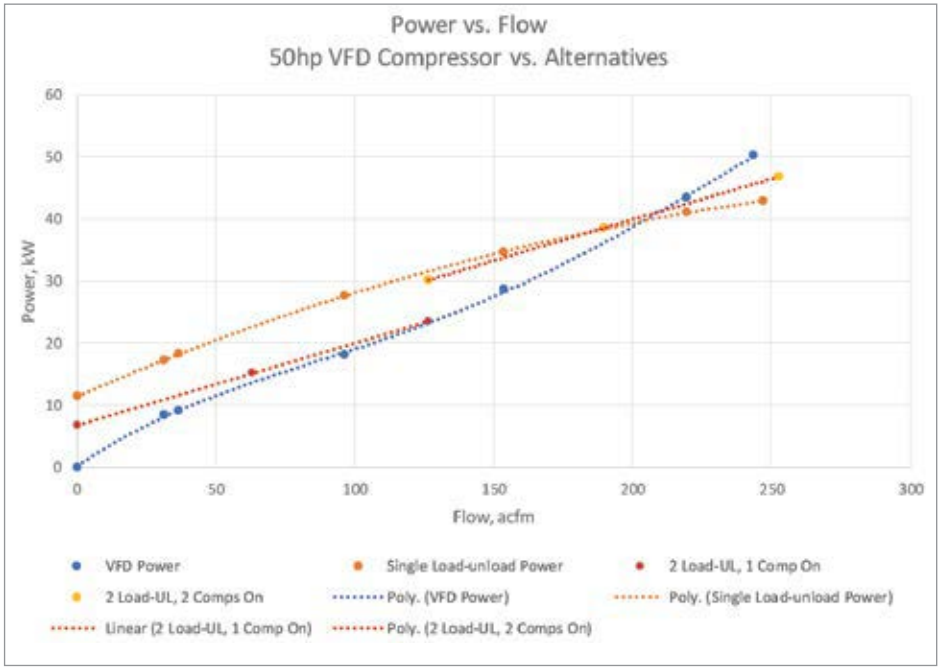

Figure 2. Comparing VFD with a single load-unload and a duplex half-sized load-unload alternatives.

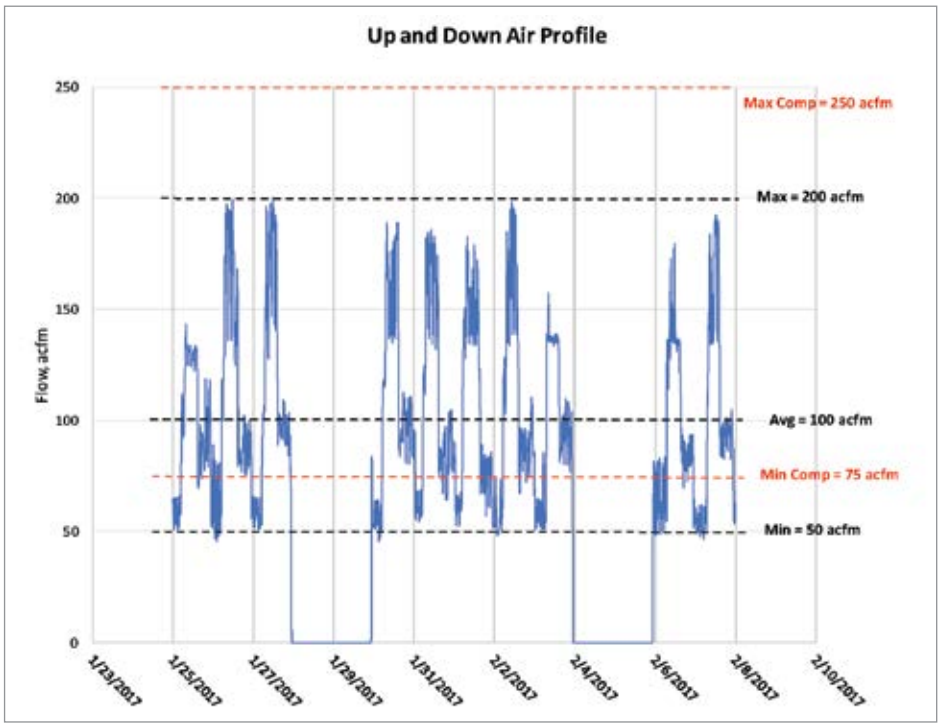

Figure 3. Load profiles with multiple demand peaks can be problematic for a single VFD.

The reason you don't want to frequently be above 80% is that its efficiency drops off at the high end also, and current is high at that point. It's because the compressor "windage" losses are high. It's "tip speed" is higher than ideal. Figure 1 shows a typical performance curve (from the CAGI data sheet) for a 50hp VFD screw compressor.

Just for comparison, I compared this compressor with two alternatives from the same manufacturer, a single load-unload and a duplex half-sized load-unload. See Figure 2.

Even though the VFD compressor "specific performance" (kW/100 acfm) is less than ideal at the lower speeds, its losses are lower than the fixed losses of the load-unload alternatives, especially at the low end. However, note how the load-unload compressors are better at the high end, and the duplex close much of the profile except 50% to 70%. But remember the low oil heating and high motor winding heating at the low end.

Let's look at a load profile (Figure 3) that might not be well suited for a single VFD compressor. It's the one where there are multiple large demands that come and go, and pressurization with low demand in between. See below. When you size your compressor 25% over peak demand, you could end up running into a turn-down problem on the other end in this type of profile. The demand is at the low end of a 50hp VFD compressor 34 hours per week. Depending on whether production is high often enough, you might want to use a multiple compressor system for this type of demand, ideally a duplex 25hp. It's a judgment call.

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SIZING VFD AIR COMPRESSORS FOR SINGLE-COMPRESSOR SYSTEMS

Here's my rule on matching flow profile: If one VFD compressor can be sized to being in the 30-80% flow range most of the time, it might be a good fit.

Low Demand Time Isn't Excessive

This is harkening back to the low-end problem. If the plant is pressurized all the time, but only runs one shift, this would mean the air compressor is just feeding leaks two-thirds of the time. Smaller plants, where single VFD compressors work well, have lower leak loads and more down time to fix them. The Figure 4 chart is for a two shift operation with a low second shift. I tweaked it to be one shift, below. The low-end time went to 80 hours per week. Single VFD compressors are good for two-shift and three-shift operations, or ones where the compressor is shut off at night, not single-shift operations that stay pressurized most of the time.

Here's my rule on low demand: If demand is below 30% of VFD size, more than 30% of the time, a single VFD compressor might not be a good fit.

Production Process is Stable

Some plants are built to do one thing, and run until the equipment has reached the end of its useful life or the market disappears. This is typical when there is a major investment once, like a stretch film manufacturer with two production lines. This is a relatively small plant that can be fed by a 50 hp air compressor, and demands are not that changeable, mostly static pressure and small cylinders. On the larger end, it could be a small corrugated or linerboard plant with one machine.

However, systems as they get larger get more random in their demand, and change more frequently. Especially plants that I call "classic car collections". These plants are a big warehouse building that a group of investors throw random used production machinery into. Like a food plastics manufacturer (molding operation) or a "nutraceutical" (health pills manufacturer). Since there is plenty of available used machinery out there, and it can be bought and put on a flat bed truck easy enough, the plant is a collection of a bunch of used machines that fit market niches. Small systems are typically supporting one to two production lines, and the plant is built and run into the ground with those lines. Larger plants are sometimes collections of always changing production lines. You can flow measure all you want, and you should, but you won't be able to hit the sweet spot of one VFD compressor.

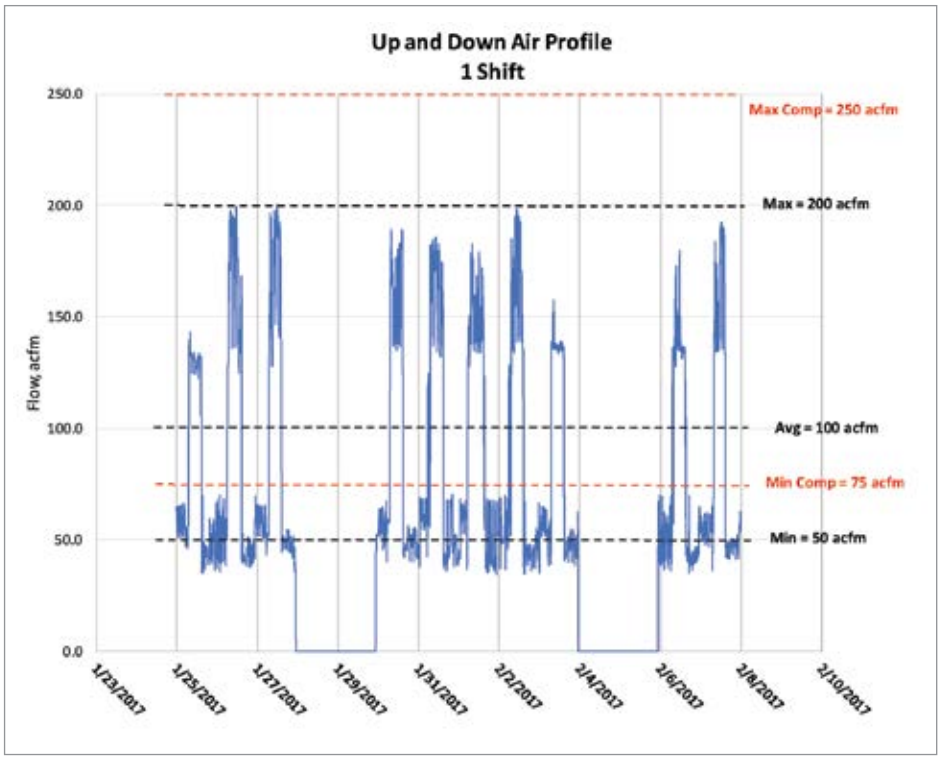

Figure 4. Measuring periods of low demand.

Here's my rule on demand randomness: If the plant's production system is stable, a single VFD compressor might be a good fit.

System Is Centralized

Making a compressed air system work that has a supposedly single VFD air compressor in one area and other compressors strung around, that it was intended to replace, doesn't typically end up operating well after a few years. The other compressors can automatically or manually start, and make the VFD not operate in its sweet spot any more. So, avoid these scenarios by applying VFD compressors to already centralized systems, or make the systems centralized by de-commissioning outliers and building up the center.

In general, most smaller American manufacturing plants don't have a "compressor room" at all. Compressed air equipment (compressors, dryers, tanks) are jammed in wherever there is room, often not in the same place as each other. I call these "compressor areas". Larger, well-engineered plants have (or had) a

centralized compressor room that is designed large enough – and has adequate electrical supply and cooling capacity – for the largest potential compressed air system that might be needed. How often does that happen? Not often. Even "centralized" systems end up being in the "slum" of the plant, the old part where no investment is occurring, and the new equipment and additions go out to the periphery, and another compressor is added. Don't all new production buildings need a compressor? Building designers think so …

As you can see from my comments, based on experience in hundreds of plants, the number of plants with centralized compressor rooms that are going to stay that way are not in the majority. As a facility engineer, system designer or supplier, you should move management in that direction, if not all in one swoop, gradually. Consider piping distribution, storage and other factors in that decision.

Anyway, if you have a large enough piping loop and single compressor room for at least 50% over the current peak demand, you're probably OK with an assumption that the compressor room location is stable for the life of the plant. Now you can site a VFD compressor in that room, provide adequate cooling and ventilation, with its standby right beside it, and dryer(s) for both. Ideally with demand controls. OK I'm getting into system design again, I apologize.

Here's my rule on centralization: If the compressor room is new or can be modified to be permanently centralized, a single VFD compressor might be a good fit.

You Can Afford a Full-sized Backup

If you spend all your funds on one air compressor, and can't get a backup, you just reduced the reliability of your plant significantly. You are more reliable with two working 20-year old compressors than with one brand new one. VFD compressors can be tricky while they get through "infant mortality", and if you don't have back-up, you might have the plant shutting down due to dirty power, vibration, high temperature cooling air, and a bunch of other things that your old compressors used to tolerate. So if you get a new Tesla, make sure you have that old Lincoln Towncar ready to go, or go get one, and put it in hot standby.

Here's my rule on backup: Have a full-sized back-up for a single VFD compressor system.

Conclusion

If you install your single VFD compressor according to these rules, you'll have a good chance at hitting your objectives-just make sure of them.

1. Stay in 30-80% speed range.
2. Stay out of single-shift always pressurized systems.
3. Apply to stable systems.
4. Apply to centralized systems.
5. Have a full-sized back-up. BP

For more information, contact Tim Dugan, tel: (503) 520-0700, email: Tim.Dugan@comp-eng.com, or visit www.comp-eng.com.

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End Use Focus Improves EFFICIENCY AT PARRHEIM FOODS

By Ron Marshall, Marshall Compressed Air Consulting

Parrheim Foods, a division of Parrish and Heimbecker, is an innovative starch, protein and fiber mill situated in Saskatoon, Saskatchewan, Canada. The plant has improved system efficiency and reduced production problems by addressing some problems with the consumption of compressed air by their reverse pulse baghouse cleaning operations. This effort has allowed them to turn off one of their 100 hp air compressors, saving significant electricity costs.

Background

Parrheim had been experiencing problems with their compressed air system for a while, especially with water contamination. Despite using desiccant dried air, free water was collecting in the plant piping and fouling the air used to clean the bags in their 14 different baghouses, which are used to filter fan powered process air. This wet air caused issues with the cleaning process of the filter, leading to the filters plugging, increasing maintenance costs and down time.

The facility had installed two 100 hp air-cooled lubricated screw air compressors rated at about 460 acfm outfitted with variable capacity control. Two small-storage receivers sized about 1,000 gallons total were located ahead of a 500 cfm pressure/flow control valve. To condition the air, a 400 cfm heatless desiccant dryer was installed. In the initial stages of new plant operation, only one air compressor ran at part load, and it wasn't expected a second unit would be required. To save costs a smaller dryer was installed, rather than one that could handle the full capacity of both compressors.

But as time went on, the plant load increased to a point where two air compressors were running, this overwhelmed the air dryer and caused significant pressure issues in the plant. The low pressure caused poor cleaning in the baghouses, forcing the operations staff to adjust the baghouse pulse frequency and pulse duration higher, using even more compressed air. The problems got so bad that the air dryer and filters had to be bypassed in order to achieve adequate pressure in the plant.

To try to solve the problems, a local air compressor supplier conducted a compressed air audit, but the study and report only dealt with the supply side issues. The report recommended that larger air compressor and dryer capacity be installed. The supplier also switched the compressors from variable capacity mode to load/unload mode and tried to lower the discharge pressure, but this caused major problems with the air dryer and

filters, reducing the plant pressure even more, and causing more water problems.

Still having problems, Brad Sliedrecht the plant Maintenance Supervisor attended a seminar sponsored by the local power utility SaskPower. At the seminar, among other subjects, was a half hour presentation on compressed air optimization which touched on some basic ways to improve compressed air systems in an energy efficient way. Impressed with the presentation, Brad invited the speaker to have a look at their system and recommend some improvements.

Findings

Parrheim is fortunate that their power utility provides 50% funding for optimization studies on compressed air, with a further 50% refunded back if an efficiency project is completed. As part of a funded study, the energy consumption, pressure profile, and flow was monitored, as required, to create a baseline (Figure 2). The results showed the system consuming over 1,100,000 kWh and costing over $100,000 per year in energy costs while producing, about 460 cfm of compressed air. The system specific power was 28 kW per 100 cfm (not including the bypassed dryer), much higher than the typical 20 kW/100 cfm of an optimized system. The system flow averaged slightly higher than one fully loaded air compressor, requiring the second compressor to run very lightly loaded.

The pressure profile showed that, while the air compressors ran at discharge pressures of between 100 and 125 psi, the plant received average pressure of only about 78 psi with normal minimum pressures reaching as low as 65 psi. The profile showed that when one compressor failed, or was turned off for maintenance, the pressure fell to as low as 55 psi due to inadequate backup capacity.

Figure 1: Baghouses represent about 95 percent of the plant compressed air loading

END USE FOCUS IMPROVES EFFICIENCY AT PARRHEIM FOODS

End Uses

As part of the assessment, a survey of end uses was done. The auditor thoroughly scanned the plant for leaks and noted significant consumers of compressed air. It was found that a small, infrequent compressed air consumer was located outdoors at a starch unloading station, but the rest of the plant was indoors in a heated environment. This meant that the full plant did not need desiccant dried air.

The survey found that there were 14 different baghouses located in the facility. A full inventory of these loads was conducted. In total there are 100 reverse pulse valves operating at frequencies of one pulse every 2 seconds to as long as one every 14 seconds depending on the duty. Due to the poor quality air in the blast, the pulse duration had been adjusted as high as 400 milliseconds on some filters, with the average 350 milliseconds. The auditor noted that the as-found duration was much higher than the normal 100 to 200 milliseconds seen with typical filter operation. It was estimated that these blast valves represent about 95% of the average plant compressed air demand.

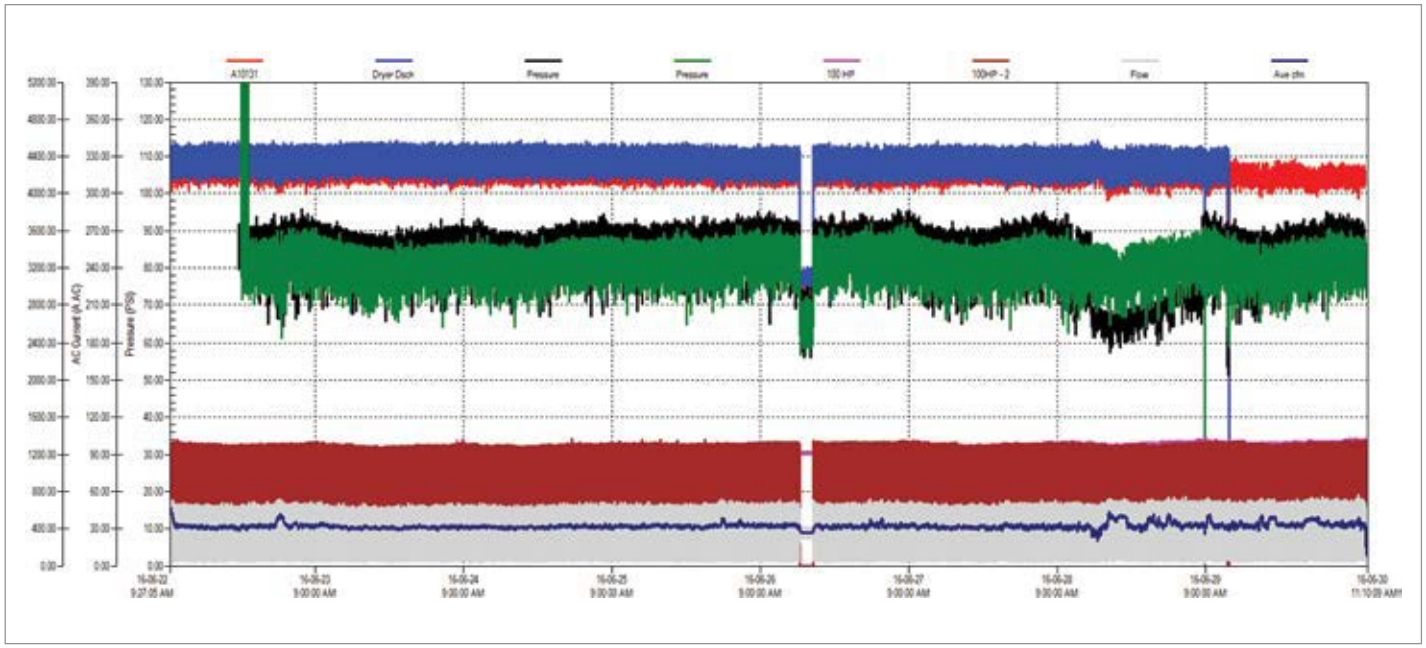

Figure 2: Compressed air profile during baseline measurements showed low plant pressure and lack of capacity

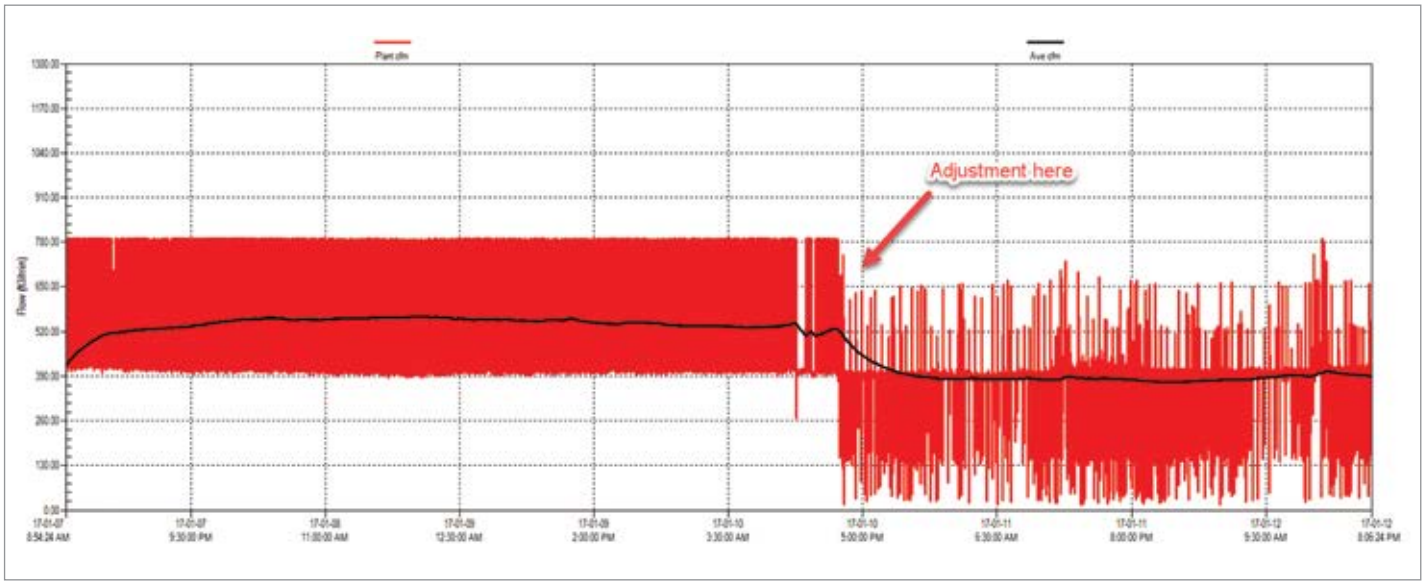

Figure 3: Reducing the pulse duration of the baghouses reduced the compressed air load to within the capacity of one compressor.

Immediately, it could be seen that if the plant pressure could be improved, something could be done about the excessive pulse frequency and duration. Analysis showed that due to the random nature of the pulses, the various pulse times of the filters would often line up so that when multiple valves fired at the same time, there were huge peaks being demanded of the pressure flow controller. Since the existing valve was only rated at 500 cfm, it could not properly regulate flows exceeding its capacity, and the plant pressure would drop to lower levels as a result.

To improve the situation the pressure/flow control valve was bypassed, allowing the plant pressure to rise. This immediately provided a noticeable change to the cleaning pulse force, but the downside was an increase in flow. Since the pulse cleaning is not regulated in this plant, the increase in average pressure by an average of 16 psi, also increased the average plant flow by about 14 percent due to the artificial demand effect.

Part way through the collection of data one of the air compressors went down. With no backup the plant, maintenance personnel were faced with the choice of low plant pressure, affecting production, or doing something about the pulse duration. The duration was adjusted to 150 milliseconds for all baghouses and immediately the average plant flow decreased to 370 cfm, a reduction of 90 cfm from previous levels (Figure 3). This change was enough to allow one of the compressors to turn off during normal loading.

Dryer and Filters

The 400 cfm air dryer was grossly undersized for the baseline loading of two air compressors and even had difficulty processing the air for one 460 cfm compressor when running in load/unload mode. Using this small dryer to try to process about 900 cfm of peak air demand when the second compressor loaded caused huge problems due to the fluidization of the desiccant bed. The high velocities caused the beads to rattle against each other and quickly plugged the dryer discharge filter (Figure 4).

Obviously increasing the dryer size was required, but if replaced with a desiccant style a doubling of purge flow would occur. In addition to this, due to a dusty environment, higher than desired compressor discharge temperatures were experienced in summer conditions. Prudence would dictate oversizing the dryer to ensure adequate dew point in worst case conditions. Since all of the process load is indoors and heated a 1,000 cfm cycling refrigerated dryer was specified, with a small point-of use desiccant dryer to be located for the infrequent outdoor use in winter (can be bypassed in summer). This reduces compressed air demand due to purge by 60 cfm and avoids the potential 150 cfm of purge flow an oversized desiccant dryer would consume. The cycling characteristic

END USE FOCUS IMPROVES EFFICIENCY AT PARRHEIM FOODS

of the new dryer ensures the refrigeration system turns itself down when the dryer is running at a fraction of its moisture loading, saving energy.

Wet receivers sized at 800 gallons were specified to be placed before dryers and filters. The dryer inlet filter is to be a mist eliminator type with low pressure differential. The wet receivers give an additional place for overheated discharge air to cool and the water to fall out. It also reduces the peak flow through the dryer, causing a smoother flow of air, and less stress to the dryer.

Pressure/Flow Controller and Piping Loss

Baseline measurements showed that the pressure loss between the discharge of the compressors and the outlet of the pressure flow controller during system peaks exceeded 15 psi, even with the dryer bypassed. Further to

Interview with Brad Sliedrecht, Maintenance Supervisor, Parrheim Foods

Q: What is your title and what is your responsibility?

A: Maintenance Supervisor, responsible for all aspects of facility maintenance, project implementation and other operational duties.

Q: Why were you first interested in a compressed air assessment?

A: A supplier told us our air compressors combined were too small for our compressed air demand and needed replacing along with our air dryers.

Coincidently, Saskpower had invited us to a conference in Saskatoon the following month. At this conference we gained some valuable information talking with specialists in the different industries.

One of these was the author of this article, Ron Marshall. His lecture was eye opening in many ways, and I felt I should use his knowledge of compressed air systems to confirm some earlier recommendations from other suppliers, so I could confidently forward these to my boss. I am glad I did, the earlier audit results proved to be right, the plant was consuming too much air, but the recommendations were not. Having an independent and 3rd party consultant take a second look proved beneficial.

Q: Were you surprised by any results?

A: Yes, we were told our existing air compressors and dryer needed to be replaced to meet our system demand. But the audit proved the compressors were sufficient, in fact our dryer would also have been sufficient, but the type we had installed used far more air than others available on the market.

Right now one compressor is in standby as a top up compressor and the other supplies the demand, and we haven't fully completed the project yet. This has enabled us to once again auto cycle our compressors keeping the hours balanced and also service the compressors without shutting down the system or reduce the air supply to the system effecting processes down the line.

Q: Was the assessment helpful?

A: Extremely, our compressed air hp demand is lower, baghouse snaps clean the socks better, and compressed air peak capacity is available on demand without the added concern of it is effecting the performance of systems and processes further down the line.

Cleaning out our baghouses takes less time and breaching is almost non-existent, the added tanks thus far have proved they will eliminate breaching. All in all, our entire system has improved. Efficiency is up, downtime is down. What more can be asked of maintenance?

Q: What do you intend to do in the future?

A: The results from the audit have proved themselves and we will continue implementing the recommendations with the expectation that all associated equipment and processes will perform better and we will also see further reduced compressed air demand costs.

Q: Any recommendation to others about assessments?

A: If we did not have it done, I expect we would be still waiting for capital approval on larger air compressors as well as driers. The air study brought to light the fact that replacing the compressors, yes, would have increased the air available to us but that was not the problem. It would not have fixed the issues we had within the system.

The advice from service companies is only an outside look at the system, to get accurate information on what is actually happening, it is crucial to have an air audit completed by an experienced company. I advise third party auditors. This ensured, for us, that our plant remained running, with immediate solutions. Our plant demand for dry compressed air was limping along. We have reduced compressed air costs, we are meeting our present needs and have reserve air to meet the plant demand for compressed air, and the efficiency of related systems and processes has improved.

this, between the output of the flow control and the end uses a pressure loss of an additional 10 psi was measured. The piping is two inch size which is much too small for the full output of two fully loaded 100 hp compressors, pipeline velocities of 80 feet per second were being experienced, much higher that the best practice of 20 fps. Recommendations were given to upsize the piping by installing a larger parallel run of 3 inch.

Further system improvements have been done or are ongoing:

- The air compressors were returned to Variable Capacity Mode and an internal sequencing feature was activated. This coordinates the compressors into a single pressure band control, lowering average pressure, and coordinates the operating of the second compressor, shutting it down when not needed and sharing the hours between units. Variable capacity mode reduces wasteful unloaded run time, which was a problem when the previous auditor switched the compressors to load/unload mode.
- Compressor discharge pressure has been lowered, both reducing artificial demand and compressor power consumption.
- A small receiver tank of 30 gallons was installed on one problematic baghouse to reduce peak flows demanded by the unit and to give the pulses more "pop" to clean the bags better. Figure 5 shows a typical recommended method of doing this. This retrofit will be applied to all plant baghouses to reduce peak flows seen by a new larger pressure flow controller.
- Leakage testing was done with a few items identified for repair.

Conclusion

The results of this study show the value of looking at the items that contribute to the plant load, rather than just in the conditions in the compressor room. Too often significant savings potential is missed if an end use survey is not done. The system assessor did the work and found enough flow reduction to allow the plant to turn off one air compressor, which almost always results in very large savings. In all, the plant audit identified enough savings to reduce the cost of operation by 55 percent, worth roughly $56,000 in lower electricity bills. SaskPower has committed to contributing some incentive funds to help pay for the cost of improvements. Further production benefits are already being experienced, with more to come when the project is completed. The successful implementation of the audit recommendations will provide enough back-up capacity to enable a planned plant expansion to occur with minimal required additional capacity. BP

Figure 4: High velocities in the dryer pulverized the desiccant beads clogging the filters, this had been changed a few weeks earlier.

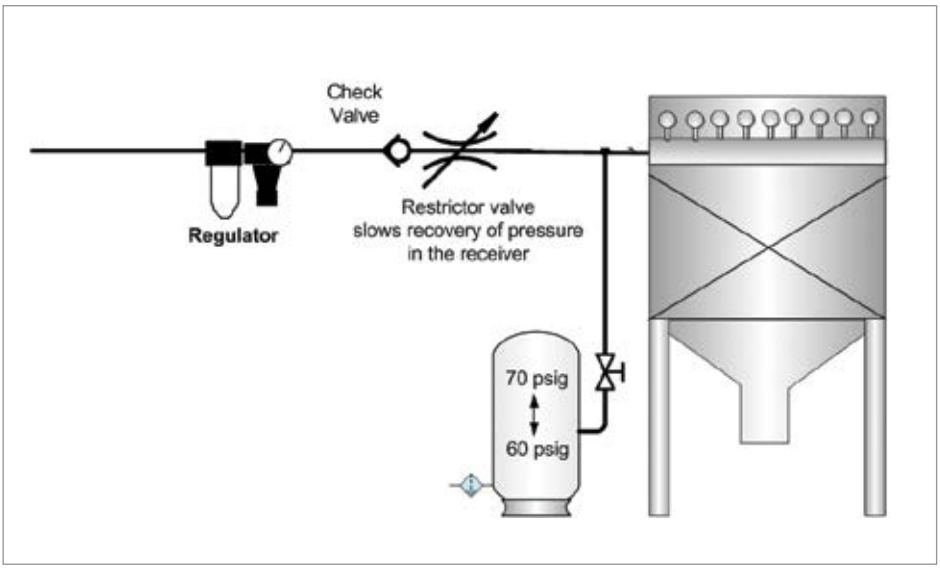

Figure 5: Peak pulses are reduced and pulses strengthened by added storage to baghouses. (Source: Compressed Air Challenge)

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

To read similar ***End Use System Assessment*** articles visit www.airbestpractices.com/system-assessments/end-uses

Show Report: THE 2017 HANNOVER MESSE

By Rod Smith, Compressed Air Best Practices® Magazine

The 2017 Hannover Messe attracted 225,000 visitors with 75,000 coming from outside Germany. The over-arching theme of the event was the Industrial Internet of Things – or Industry 4.0, as it is known in Germany. Dr. Jochen Köckler, Member of the Managing Board at Deutsche Messe commented,"Over the past five days, Hannover has served as a global hub for all things related to Industrie 4.0. Every sector involved in the digitalization of industry was on hand to showcase its answers to the key question faced by industrial enterprises everywhere: How can I best get my company into shape for the digital future?

I hope you enjoy a small sampling of what I saw as I roamed the show. Due to article length limitations, I have to apologize in advance to the many booths I do not mention and to the fact I only have space to write about one technology per booth.

Huge News from Sullair – Twice!

I started the week making a beeline for the Sullair booth. They had been quite mysterious beforehand saying there would be an important new product unveiling on the first day of the show. What I saw at the Sullair booth was, for me, the biggest news of the week – a brand new, world-class designed LS Series rotary screw air compressor. "This new technology platform for the LS90 and LS110 (125 and 150 horsepower) models takes Sullair to a completely new level," said Vice President of Product Management Jon Hilberg. "This significant investment will next be deployed on our 200 to 600 horsepower models."

Brit Thielemann and Jon Hilberg in front of the new LS Series rotary screw air compressor (left to right).

The new patent-pending 230 mm air end features a brand new casting with internally ported lubricant passages. "This is our biggest air end advancement in 30 years. We went from fifteen to two piping ports," said Sullair's Brit Thielemann. "We listened to our customers and now have standard TEFC motors, Wye-Delta starters and a newly innovative electronic spiral valve with up to 60% turndown." The Sullair team said the new Electronic Spiral Valve is less vulnerable to contaminated environments than variable speed drives and provides a pricing advantage. As always, Sullair will continue to offer customers both capacity control options. The system also featured a new STS 10" color touch screen controller for sequencing up to 16 compressors and integrated graphing and trending for performance analysis.

Hitachi Acquires Sullair in a Historic Acquisition

Of course, the second piece of news regarding Sullair was Tuesday's surprise announcement that Hitachi had acquired Sullair for $1.245 billion.

Masakazu Aoki, Executive Vice President at Hitachi and CEO of the Industrial Products Business Unit, said, "I am very pleased to announce that Hitachi has agreed with Accudyne to proceed with the acquisition of Sullair, a leader in the air compressor business. Through this fusion with Sullair's strengths, Hitachi will increase its competitiveness and strengthen the air compressor business, and at the same time, by utilizing Sullair's global footprint, mainly in North America, we will accelerate the global rollout of the Social Innovation Business."

Charles Treadway, CEO of Accudyne, said, "We are very pleased with the transaction, as the combination represents a uniquely attractive opportunity for Sullair, its employees, distributor partners and end-customers." Jack Carlson, Sullair President, said, "We are thrilled by the prospect of partnering with Hitachi to grow Sullair as we embark together on the next chapter in our proud history."

Air Compressors

I had the chance to visit with Kaeser USA President Frank Mueller and Dr. Erwin Ruppelt. An important concept they brought out is the idea of "a digital twin" (virtual reality compressed air system) facilitated by the Sigma Air Manager 4.0 – the master control system used by Kaeser. The "digital twin" idea is to be able to model how the system would perform under hypothetical scenarios. How would it perform at 80 psi vs. 100 psi? What would the energy consumption be – which air compressors would be working and at what duty cycle? What if demand increases by 25% - what would happen to the system? What would happen if you added a VSD air compressor? This is very interesting for those wanting to truly understand the system – particularly as compressed air system dynamics, in any given plant, are always changing. Kaeser provides clients with the ability to visualize, with 3D drawings "from the cloud", what a new system would look like physically. Kaeser also announced the introduction of synchronous reluctance motors on the variable speed versions (SFC) of the ASD Series. This completely new drive technology, developed together with Siemens, can deliver efficiency gains of up to ten percent under partial loads.

Hertz Kompressoren had a huge booth and is entering the U.S. having established a warehouse in Charlotte and named Robert Groendyke as the Vice President and General Manager. They told me their "phase 1" will be with UL and ASME approved lubricated screws up to 75 horsepower. We took a look at their Eagle Series of two-stage, oil-free, 150 to 430 horsepower, rotary screw air compressors. Tested and approved as completely oil-free by TUV Rheinland, these direct-drive units have a non-abrassive "ultracoating" on the rotors and use stainless steel rotors in the high-pressure stage. The units have variable speed drive, automatic greasing system and heat recovery options. As a side note, Hertz has also announced a joint venture with IHI on oil-free centrifugals.

Ingersoll Rand introduce new 200-250 kW models to its line of Next Generation R-Series oil-flooded rotary screw air compressors. The units are available with a new single-stage airend or a two-stage airend that increases airflow by up to 16 percent. Their literature states the new fixed-speed models are 10 percent more efficient than legacy models and the variable speed option is up to 35 more efficient that the industry average.

BOGE introduced the new and updated C-2 Series lubricated rotary screw compressors specifically for the U.S. market. The 15-30 horsepower units are now direct driven with standard options such as variable speed drive, tank-mounted and heat recovery. Gavin Monn and Jerry Elsen were very excited to launch the new C-2 Series in

Frank Mueller was talking about the Sigma Air Manager 4.0 at the Kaeser booth.

Kathy Briede next to the new Ingersoll Rand R-Series 250 kW air compressor.

Mustafa Canbaz and Elif Sasmaz in front of the Hertz Kompressoren Eagle Series oil-free rotary screw air compressor (left to right).

SHOW REPORT: THE 2017 HANNOVER MESSE

Gavin Monn and Jerry Elsen next to the new BOGE C-2 direct drive rotary screw compressor designed for the U.S. market (left to right).

Giulio Contaldi and Jay Hedges next to the new Mattei Maxima 75 kW Xtreme rotary vane air compressor.

Jan Hoetzel and Jesus Molina next to the new EASY master controller from Airleader (left to right).

the U.S. BOGE also has extended their EO range of oil-free scroll air compressors, available in simplex, duplex, triplex or quadplex packages covering the range of 5.5 kW, 11 kW, 17 kW and 22 kW. They can be ordered with integrated or separate refrigerated dryers, be tank-mounted as a duplex, and are very quiet at 59 dB(A). Last but not least, BOGE also introduced the 110 kW model of their innovative HST High Speed Turbo oil-free air compressor line – joining the 220 kW model launched two years ago.

Mattei Compressors is led by CEO Giulio Contaldi and in the U.S. by our own Jay Hedges. The company is in the middle of a round of significant new investments in three new OKUMA airend machining centers and a new R&D center, new SAP information systems and a continuous flow of aggressive product introductions. The new belt-driven BLADE Series has been successful with its' U.S. introduction and Hedges reports their U.S. operation does the packaging to turn three base models into 48 SKU's providing voltage, pressure, and tank-mount options to name a few. Mr. Contaldi also announced the completion of third party testing project, by Intertek in the U.S., where they saw a specific power improvement of 3.8% from their rotary vane air compressor – after a "running-in" period of 1000 hours. This is sure to generate some discussions.

Did you know that U.S. based Dover Company owns an air compressor outfit? Germany's Blitz Kompressoren has been in the air compressor business for almost 100 years and is part of their portfolio. A colleague from my prior life, Rolf Tappen, has recently come on board as General Manager and they have launched the new 15-90 kW frequency controlled Monsun rotary screw compressor line. Tappen has a strong history of business development - I would keep my eye on this company.

Tamturbo continues their introduction of 100% oil-less, high speed, variable speed, turbo compressors. These Finnish entrepreneurs with long histories in air compressor airend engineering, explained to me their titanium turbo impellers, gearless direct drive, active magnetic bearing design philosophies. They have 200 and 250 horsepower three-stage models right now which will eventually be a 125 to 400 hp product line. They plan to develop a 75 to 300 hp two-stage product line in the future. Hannu Heinonen explained to me they are targeting the oil-free rotary screw market with this technology.

Jan Hoetzel, from Airleader USA, showed me their new EASY master controller for up to four air compressors. One air compressor can be a variable speed drive unit. The controller can manage information from up to 8 sensors. Information can be shared with a web server and viewed on smart phones via WIFI connections. This is a new "value" product from Airleader aimed at making this type of control more affordable and easy (good name). They are targeting a third quarter

introduction for this technology in the U.S. Airleader is interesting to me because they have been talking about "modeling" compressed air systems for a long time-before the Industry 4.0 buzz began. What happens to my system if this system dynamic occurs? What would my energy consumption be if we added this new air compressor? Good stuff.

Compressed Air Treatment and Measurement

BEKO Technologies continues to innovate with Industry 4.0 ideas – like using instrumentation to "talk" to compressed air dryers. BEKO has invested heavily in their own range of oil content, flow, pressure, dew point, and even particulate measurement instruments. These can now help compressed air dryers operate more efficiently and reliably. With their DRYPOINT M eco control membrane dryers, for example, one can set an unusual dew point at for example -20°C (-4°F) which is ISO Quality Class 3 for dew point. This will reduce the purge air requirements of a – 40°F dew point – while assuring dew point stability if inlet conditions to the dryer change. The BEKO team also showed me their innovative portable compressed air testing unit – able to test ALL of the compressed air key performance indicators listed above. I believe every air compressor service company should own the ability to test compressed air quality for their customers-at the point of use. Further, BEKO showed me their new "high-value" line of Metpoint MCA monitors – where users can easily monitor these KPI's. When I'm asked about what the future holds for compressed air – I always answer, "measurement, measurement and more measurement."

JORC introduced several new Industry 4.0 concepts into the compressed air condensate management technologies starting with a new timer drain concept. They have eliminated the potentiometers (the time cycle knobs)! You can program the ON and OFF intervals from your smart phone. A key advantage is the knobs can't be tampered with and left ON as we often see. President Jan de Bie also showed me their "no air-loss" KAPTIV-CS drains, where they've introduced a digital sight port so one can monitor the condensate level in the reservoir and monitor the operation. JORC introduced their vision of being able to wirelessly monitor and control all drain and oil-water separator operations to ensure reliable condensate management.

SPX FLOW launched the new FLEX Series of phase change material (PCM) energy saving refrigerated dryers. James Doherty and Jay Francis explained to me that PCM is a material that harnesses latent heat produced as it converts from solid to liquid or liquid to solid. Now I have to go review my latent heat fundamentals! Designed with a 3-in-1 heat exchanger, the PCM encapsulates the refrigeration and air circuits, allowing the PCM to stay colder for longer periods of time. This

Tilo Fruth, Manfred Lehner and Norbert Strack next to the DRYPOINT M eco control membrane dryer from BEKO Technologies (left to right).

Jan de Bie and Aaron de Koning explained their vision of remote monitoring and control of compressed air condensate management systems (left to right).

Cole Isban, James Doherty, Jose Larios and Ben Lee next to the new FLEX energy-saving refrigerated dryer from SPX FLOW (left to right).

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Peter Fearon, David Peters, Don Joyce, Adam Wright and Andrew Brighton with nano's next generation GEN2 nitrogen generator (left to right).

Roberto Bettin next to the new ETM DM large-capacity drying module from MTA.

Menno Verbeek and Patrick Boers with their flow meters at the VPInstruments booth (left to right).

cycles the refrigerant compressor less often than conventional energy-saving designs. Another benefit is that the PCM itself is an eco-friendly refrigerant that melts and solidifies above 0°C (32°F) and does not require the use of glycol, pump, tank or hot gas bypass.

MIKROPOR is aggressively introducing their own brand of compressed air treatment products into the U.S. Volkan Ayhan told me their warehouse in Michigan City (Indiana) is fully stocked with UL and ASME approved refrigerated dryers, desiccant dryers and filters. He reported they have been operating in the U.S., for a few years now, and the market acceptance has been excellent.

Nano-purification solutions continues to position itself for growth, exhibiting for the first time at Hannover Messe. While discussing "what's new," nano confirmed the business has recently completed another acquisition, this time acquiring the F1 Series tooling and industrial filtration technology from their current supplier. David Peters, Managing Member stated, "Acquiring our core filtration product line further enhances the business's value, while also expanding the businesses ability to support a broader geography and customer base, which supports the business's vision of growth and capability."

MTA continues it's history as a leader in cycling energy-saving refrigerated air dryers. Roberto Bettin showed me their ETM DM enhanced thermal mass drying modules for large capacity systems. Single modules are rated for 1,800 to 5,400 m^3/h (1,048 to 3,145 scfm) and multiple TWIN and TRIO modules are rated for 7,200 to 32,400 m^3/h (4,193 to 18,870 scfm). The technology uses a patented 2-in-1 aluminum heat exchanger including an air-to-air and air-to-chilled mass heat exchanger combined with a water separator externally connected by Victaulic joints. The product literature states it is engineered with wide air channels and an oversized demister separator, it ensures optimum dew point performance with industry-leading air side pressure drops.

VPInstruments introduced the new FlowScope M with WIFI capabilities. They believe smartphones, desktop computers and tablets will be used commonly in the future to monitor and control flow, temperature and pressure in compressed air systems. VP is moving to IP based sensors to make this easy for plants. They also showed a new panel-mounted display which can be located in the plant. Both Menno Verbeek and Patrick Boers said their introduction, two years ago, of sending replacement sensor elements (instead of sending them in for calibration) has been very successful.

To read more about ***Compressed Air Technology,*** please visit www.airbestpractices.com/technology

RESOURCES FOR ENERGY ENGINEERS

TECHNOLOGY PICKS

Sullair Introduces New LS Series Air Compressors

Sullair, an industry leader in innovative compressed air solutions since 1965, unveiled its new LS Series Air Compressor.

"The LS Series is one of the most exciting launches in Sullair history," said Jon Hilberg, Vice President – Commercial & Industrial Air Solutions. "No detail has been overlooked in making this a world-class performance air compressor."

The LS Series of Compressors is the first to utilize a new, patent-pending air end design. The air end takes proven bearing technology and combines it with a new, larger rotor profile – resulting in the most energy-efficient single stage compressor Sullair has ever offered. Additionally, the new air end features all internal porting meaning fewer components are needed – which helps increase Sullair durability.

"Sullair compressors, and specifically the air ends, have been described as bulletproof by our customers," according to John Randall, Vice President – Global Engineering. "Our goal in developing this new air end was to maintain that legacy of durability, while increasing our efficiency. Now, Sullair provides customers the opportunity to combine a long-lasting compressor with the benefit of lower operating costs over its lifetime."

Beyond the new, proprietary air end, the LS Series features a patent-pending package design, in which all components are specially designed, engineered and manufactured to perform at the highest levels.

The new Sullair LS Series Rotary Screw Air Compressor

Sullair recognizes the efficiency of an air compressor is only one part of the equation. Because plant air demand fluctuates it is critical that an air compressor has the ability to adapt quickly to these changes. The Sullair LS Series is the first to offer Electronic Spiral Valve technology in all of these new models.

"The Electronic Spiral Valve represents the most cost-effective capacity control option available today," according to Brit Thielemann, Senior Product Manager – Commercial & Industrial Air Solutions. "We have taken our decades of experience in spiral valve technology and significantly upgraded it with the use of electronic controls. This new technology maintains a very tight one (1) PSI control band – effectively matching compressor supply to demand. Put simply, the Electronic Spiral Valve helps ensure our customers are not spending money making air which they don't need."

Proving compressors don't need to be complicated to operate, the LS Series is the first to feature the new 10" Sullair Touch Screen (STS) Controller. The Sullair Touch Screen Controller brings intuitive operation to the compressor with menu-driven screens allowing access to all information at the touch of a finger. Additionally, the functionality behind the Sullair Touch Screen Controller enables customers to monitor and analyze all key compressor operational information.

Recognizing customers are not always within view of their compressors, the LS Series is the first to offer Sullair AirLinx™ Remote Monitoring. AirLinx provides customers the opportunity to monitor all operational parameters in real time via computer, tablet or phone. Besides the ability to monitor operations, AirLinx may also be customized to provide automatic alerts when an unexpected reading or fault occurs. This speed-to-alert helps users minimize unplanned downtime.

Beyond the new features offered, the Sullair LS Series now includes numerous features as standard, including a full enclosure, TEFC motor, Wye-Delta starter, phase monitor and zero loss drain. Additionally, the LS Series provides numerous options to help customers meet their specific compressor needs.

Available in horsepower ranges from 125-150 hp (90 to 110 kW), the LS 90-110 compressors are capable of providing pressures from 110 to 175 psi (7.6 to 12 bar).

RESOURCES FOR ENERGY ENGINEERS

TECHNOLOGY PICKS

About Sullair

Since 1965, Sullair has developed and manufactured air compressors with proven reliability and wear-free durability. Sullair is globally recognized as a leading manufacturer of portable air compressors, contractors' air tools, stationary air compressors, compressed air treatment equipment and vacuum systems. Additionally, Sullair provides customers with a full line of aftermarket parts, fluids and services. Sullair has manufacturing capabilities in Michigan City, Indiana; Shenzhen and Suzhou, China; Mahindra World City, India; as well as a JV (IHI-Sullair) based in Suzhou. For more information, visit www.sullair.com.

Ingersoll Rand® Introduces New R-Series 200-250kW Models

Ingersoll Rand®, a global leader in compression technologies and services, introduced new models to its line of Next Generation R-Series oil-flooded rotary screw air compressors, which provide a more energy-efficient solution for customers with high capacity air requirements.

The RS200 to RS250 models are available with the new, state-of-the-art single-stage airend, or the two-stage airend that increases airflow by up to 16 percent. The new fixed-speed models are 10 percent more efficient compared to legacy products, while the variable speed option is up to 35 percent more efficient compared to the industry average.

"The ability for these compressors to deliver outstanding efficiency without compromising reliability meets the increasing demands of industries to increase productivity while reducing energy use," said Eric Seidel, vice president of product management for compression technologies and services at Ingersoll Rand. "Our Next-Generation R-Series RS200 to RS250 models help customers increase overall system reliability and decrease their total cost of ownership with new state-of-the-art features and performance enhancements that save them tens of thousands of Euros."

Ingersoll Rand has added these models to the Next Generation R-Series portfolio allowing customers who run 24/7 and rely on large amounts of compressed air to have equipment that is as reliable as their demand. According to internal testing, efficiency and design improvements on some of the high capacity compressors deliver up to a €40,000 energy cost savings over a two-year period per compressor compared to previous models[1]. The RS200 to RS250kW models are the third introduction to the Next Generation R-Series line of compressors, following the Next Generation R-Series 30 to 37kW fixed-speed and variable speed drive introductions in 2015 and 2016.

At the core of every Ingersoll Rand Next Generation R-Series compressor is an airend that is specifically designed to improve overall system efficiency. In addition to the enhanced single-stage airend, the RS200 to RS250 models are also available with the new two-stage airend. This two-stage airend is the most efficient airend available today.

Each compressor comes standard with Progressive Adaptive Control (PAC) Protection, V-Shield™ technology, floating coolers and Ultra EL Lubricant. These features help keep equipment running efficiently and maximize uptime for facilities that are manufacturing around the clock.

- PAC Protection is a unique algorithm developed by Ingersoll Rand and is integrated in the controls system within each compressor. The system monitors key performance parameters for when consumable parts are nearing the end of their life, or if operating temperatures are reaching design limits. In these situations, the controls adjust the parameters to keep the machine running without overloading the motor, preventing unnecessary shutdown.
- V-Shield technology safeguards all critical fittings by securing them with o-ring face seals in a method that is largely free from distortion. Leaks are virtually eliminated, meaning performance isn't sacrificed, regardless of how many reconnections are made.

The new Ingersoll Rand® RS250 Rotary Screw Air Compressor

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- The floating cooling system from Ingersoll Rand contains heat exchangers with finger-tight connections so they can expand and contract as needed. This new design improves overall system reliability, because welded connections reduce the ability for heat exchangers to expand and contract, which is the number one reason they fail.
- Ultra EL is formulated to last up to 16,000 hours, which is twice as long as other rotary lubricants. Ultra EL keeps compressors running at peak performance, minimizing downtime and lowering lifecycle costs.

All Next Generation R-Series air compressors are equipped with Xe-series controllers, which allow easy, intuitive access to, and control of, the compressed air system. The Xe145 controller has built-in performance analysis and graphical trending, as well as built-in sequencing for up to four compressors.

For more information on the Ingersoll Rand Next Generation R-Series air compressors, visit www.ingersollrandproducts.com or contact your local service representative.

About Ingersoll Rand

Ingersoll Rand (NYSE:IR) advances the quality of life by creating comfortable, sustainable and efficient environments. Our people and our family of brands — including Club Car®, Ingersoll Rand®, Thermo King® and Trane® — work together to enhance the quality and comfort of air in homes and buildings; transport and protect food and perishables; and increase industrial productivity and efficiency. We are a $13 billion global business committed to a world of sustainable progress and enduring results. Ingersoll Rand products range from complete compressed air and gas systems and services, to power tools, material handling and fluid management systems. The diverse and innovative products, services and solutions enhance our customers' energy efficiency, productivity and operations. For more information, visit www.ingersollrand.com or www.ingersollrandproducts.com

Parker adds Smart IO-Link Connectivity to its Valve Portfolio

Parker Hannifin, the global leader in motion and control technologies, as part of its global focus on factory automation, has added smart connectivity of its pneumatic valve islands to machine controllers by introducing new IO-Link modules that can

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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 106, Pittsburgh, PA 15241

Compressed Air Best Practices® (USPS# 17130) is published monthly except January-February combined by Smith Onandia Communications LLC, 37 McMurray Rd., Suite 106, 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 106, Pittsburgh, PA 15241.

TECHNOLOGY PICKS

be quickly integrated with existing Parker valve ranges. Ethernet based protocol independent and vendor neutral, this new module offers plug-and-play valve compatibility for customers currently using Industrial Ethernet, meaning they

The new IO-Link modules can be quickly integrated with existing Parker valve ranges.

can benefit from similar performance and reduced system complexity at a lower cost. This communication technology allows devices to be simply and easily integrated in the same way as all commonly used fieldbus and automation systems – users do not need to be trained in a new protocol. In addition, the network configuration can be stored or written into the code and downloaded to the device with no programming required.

Connected valve technology provides the option to add intelligence and decentralize control which enables advanced machine-to-machine control in a highly cost efficient and simplified way, especially when used on small to medium size machines. As OEMs look to get more performance data to their maintenance teams quickly, IO-Link offers time critical extended diagnostics (not available through traditional discrete solutions) that can prove vital in preventing costly downtime.

Upgrading to IO-Link enables Parker customers to significantly reduce time spent on commissioning and configuration therefore reducing labor costs and leading to shorter time to market. The module offers many benefits over the use of 25 pin/D-sub connectors as terminating and troubleshooting multiple points of failure is both time consuming and costly. Using standard, non-shielded, five-pin proximity switch cables and connectors helps to reduce inventory levels and costs by a factor of five compared with protocol-specific cables while still benefiting from similar diagnostics and performance as when using more complex Fieldbus connection methods.

In addition, using IO-Link gives system engineers the flexibility to design their control architecture with fewer Ethernet nodes, and at the same time, using the smaller IO-Link head module aids the development of machines with a smaller overall footprint.

About Parker Hannifin

Parker Hannifin is a Fortune 250 global leader in motion and control technologies. For 100 years the company has engineered the success of its customers in a wide range of diversified industrial and aerospace markets. Learn more at www.parker.com or @parkerhannifin.

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Sustainable Energy Savings with Compressed Air Best Practices®

Compressed Air Best Practices® is a technical magazine dedicated to discovering **Energy Savings** in compressed air systems — estimated by the U.S. Department of Energy to represent 30% of industrial energy use. Each edition outlines **Best Practice System Assessments** for industrial compressed air users — particularly those **managing energy costs in multi-factory companies.**

"Compressed air encompasses 20 percent, on average, of a Darigold plant's electrical energy spend."

– Uli Schildt, Energy Engineer, Darigold Dairies
(feature article in April 2016 Issue)

"Compressed air is our lifeline. Everything here runs on compressed air."

– Curtis Wood, Facilities Team Supervisor, HAECO Americas
(feature article in June 2016 Issue).

"Demand Side" and "Supply Side" information on compressed air technologies and system assessments is delivered to readers to help them save energy. For this reason, we feature Best Practice articles on when/how to correctly apply **air compressor, air treatment, piping, storage, measurement and pneumatic control technology.**

Industrial energy managers, utility incentive program managers, and technology/system assessment providers are the three stakeholders in creating energy efficiency projects. Representatives of these readership groups guide our editorial content.

"Compressed air optimization measures reduced consumption by 31% resulting in 3.8 million kWh and $255,000 in annual savings."

– Abdul Mohideen, Electrical Energy Manager,
PROTON Automotive, Malaysia

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Clean Sweep!

Air system study yields multiple benefits to bottom line

Problem:

An aerospace parts manufacturer was experiencing high maintenance costs as well as excessive downtime with their compressed air system. Their modulation control compressor caused unnecessary energy usage on the weekends and off peak times, resulting in exceptionally high energy costs. Additionally, problems with air quality led to product rejects and costly scrap rates.

Solution:

A comprehensive Air Demand Analysis was conducted to understand the plant's fluctuating demand. It revealed that the 200 hp modulating control compressor was grossly oversized. With proper controls and additional storage, two 50 hp compressors could efficiently handle the demand and save 871,500 kWh per year. A third 50 hp unit was added to ensure uptime and accommodate growth.

Result:

These sweeping changes created immediate and sustainable energy savings. The combination of more storage, more efficient compressors and master controls drove system specific power consumption down 77%—and that doesn't include the savings from leak reduction. As a direct result of the new air treatment equipment, the plant also saw improved product quality and reduced maintenance on the expensive production equipment that may surpass energy in terms of bottom line benefits.

Specific Power of Previous System:	93.89 kW/100 cfm
Specific Power of New System:	21.14 kW/100 cfm
Annual Energy Costs of Previous System:	$107,431/year
Annual Energy Cost Savings:	$ 87,151/year
Savings Due to Fixing Leaks	$ 12,500/year
Utility Rebate:	$ 92,000
TOTAL FIRST YEAR SAVINGS:	**$191,651**

Let us help you measure and manage your compressed air costs!