The Magazine for ENERGY EFFICIENCY in Compressed Air Systems

COMPRESSED AIR BEST PRACTICES

airbestpractices.com

August 2017

Food Packaging

COMPRESSED AIR WITH A VAST PORTFOLIO

Powering You With Extraordinary Solutions

Whether the compressed air you need is for machining, fabrication, material handling or finishing, we can help you save money while increasing your productivity. That's a promise.

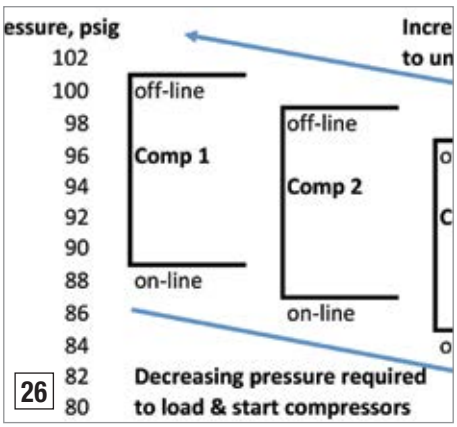
www.atlascopco.us – 866-688-9611

Sustainable Productivity

Atlas Copco

SUSTAINABLE MANUFACTURING FEATURES


22



26

COLUMNS

34

FROM THE EDITOR | Food Packaging

Factory personnel, utility incentive program managers and auditors continue to deliver system assessments with reliable returns-on-investment. We are seeing these three key stakeholders develop their abilities to "audit" more than one type of utility and optimize it. The food industry deploys all the plant utilities our publications cover; compressed air, nitrogen, pneumatic conveying, vacuum, aeration blowers, chillers and cooling towers.

Our first article, from Don van Ormer, illustrates this point. His firm has performed compressed air audits for decades. In this snack food plant audit, they also analyze the nitrogen and vacuum supply systems. The nitrogen generator was upgraded to the latest technology improving the compressed air to nitrogen ratio. The vacuum system had already been optimized and centralized and the recommendation was to avoid installing vacuum generators (venturi generators) on the box erector machines in the box room.

When an air compressor is getting old, do you replace it or overhaul it? David Grabau, from Ingersoll Rand, provides us with an article on how to know when it's time to overhaul, whether to remanufacture or rebuild, and considerations when choosing the overhaul option. This valuable article also provides a series of questions he suggests air compressor owners ask the overhaul company before contracting services.

Many, if not most, manufacturing plants operate multiple air compressors of different makes, sizes and technologies. Variable frequency drive air compressors are often added to a stable of existing air compressors. Tim Dugan has provided us with an article on the important role master controls play to ensure VFD air compressors, in this environment, are allowed to perform and generate the energy savings they were purchased for.

When a plant is growing, or wants to plan for future growth, how can one design the new compressed air system to avoid energy cost increases happening before the demand increases? Ron Marshall provides us with an interesting case study, in Manitoba, about a plant running two 10 horsepower reciprocating air compressors who decided to upgrade to a 30 hp rotary screw VSD air compressor.

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

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

2017 Expert Webinar Series
NITROGEN USE IN FOOD PROCESSING & PACKAGING
Join University of Florida Professor Bruce Welt, on September 14th, to examine applications for nitrogen in food processing and packaging.
Register and view our 2017 Webinar Calendar, please visit www.airbestpractices.com/webinars

COMPRESSED AIR BEST PRACTICES® EDITORIAL ADVISORY BOARD

Industrial Energy Managers	Doug Barndt	Manager, Demand Side Energy-Sustainability	Ball Corporation
	Richard Feustel	Senior Energy Advisor	Leidos
	William Jerald	Energy Manager	CalPortland
	Jennifer Meier	Global EH&S/Plant Engineering Manager	Varroc Lighting Systems
	Thomas Mort	Senior Auditor	Thomas Mort Consulting
	Brad Reed	Corporate Energy Team Leader	Toyota (retired)
	Brad Runda	Global Director, Energy	Koch Industries
	Uli Schildt	Energy Engineer	Darigold
	Thomas Sullivan	Energy Performance Manager	Michelin North America
	Bryan Whitfield	Paint & Powder Booth Specialist	Fiat Chrysler Automotive
Compressed Air System Assessments	David Andrews	Director Marketing Communications	Sullair
	Erik Arfalk	Vice President Communications	Atlas Copco
	Steve Briscoe	VP Energy Management	IAC Air Compression
	Paul Edwards	President	Compressed Air Consultants
	Tilo Fruth	President	Beko USA
	Chris Gordon	President	Blackhawk Equipment
	Phil Kruger	General Manager	Harris Equipment
	Frank Langro	Director Marketing	Festo
	John Lucidi	Sales & Marketing Manager	Parker GSF Division
	Wayne Perry	Sr. Technical Director	Kaeser
	Jim Timmersman	Senior Auditor	Power Supply Industries
	Hank Van Ormer	Technical Director	Air Power USA
	Compressed Air & Gas Institute, Compressed Air Challenge		

2017 MEDIA PARTNERS

COAIRE AIR COMPRESSORS

When you need an air compressor that's manufactured with precision and engineered innovation, look no further than Coaire Air Compressors. Each compressor is built and tested to ensure reliability and stress-free performance. With a wide range of air compressors to fit any application, Coaire is the right choice.

OIL INJECTION SCREW

OIL FREE SCROLL

OIL FREE SCREW

COAIRE 562-463-3935 Learn more at www.coaire.com

ISO 8573-1 ZERO Class 0

INDUSTRY NEWS

BEKO Offers EPA 608 Refrigerant Circuit Certification Class

The Environmental Protection Agency (EPA) requires all technicians working on refrigerant circuits must have the EPA 608 certification. The EPA will enforce heavy fines if any technician is caught working on a piece of equipment without a license where refrigerant is in use.

BEKO Technologies is now offering a two-day, EPA 608 certification class available to all of its customers.

Any individual working on refrigerant circuits must have the EPA 608 certification, or face strict fines.

During the course, attendees will learn how the refrigerated equipment works, basic and advanced troubleshooting repair techniques, required rules and regulations, and the best practices related to working on refrigerant circuits safely and effectively. Technicians will get an in-depth look at products from BEKO Technologies during the training, although this course is not intended to provide any particular product focus. Thus, the acquired knowledge is applicable to all refrigerated equipment.

The cost is $649.00 per person, including all study materials and the administration of a closed book test at the end of the course. Provided the technician passes the test, they will be presented with an EPA 608 certification card.

For groups of five or more, BEKO can offer this course on-site at your facility. However, your facility must be properly set up and equipped to accommodate the requirements of the course, including, refrigerant dryers on-hand, a workshop area, test equipment, etc. Travel expenses for the on-site certification offering are paid separately.

In addition, BEKO Technologies will conduct a class at their headquarters in Atlanta, GA on October 16-17th, 2017. More information regarding specific details of the class will be available soon.

For more immediate inquiries, please contact your Regional Sales Manager or our Technical Service Manager, Mr. Thomas Esch, at thomasesch@bekousa.com or by telephone at (678) 628-3139. Or visit www.bekousa.com for more information.

RENT BIG,
OIL-FREE,
MOBILE
AIR

relevant.

Relevant Solutions offers rentals for *any* need. Including: air compressors (performance from deep vacuum service through pressures to 600 psi), nitrogen generation and associated equipment (dryers, starters, cooling towers, transformers, tanks etc).
Call Relevant Solutions at 1-888-RENTAIR for your rental needs.

EMERGENCY PLANNED LONG-TERM

relevantsolutions.com/rentals

Sullair and CompressAir Host Incentive Program Event and Tour for NWIBRT

CompressAir and the Northwest Indiana Business RoundTable's (NWIBRT) Business Development & Marketing committee held the group's first event detailing a NIPSCO incentive program. The NIPSCO Commercial and Industrial Energy Efficiency Incentive Program and Plant Tour was held for over 30 NWIBRT members and featured presentations from Sullair and Lockheed Martin. The attendees ranged from end user plant engineers to mechanical and electrical contractors.

"The collaborative effort of NWIBRT, Sullair, Lockheed Martin and CompressAir to educate and bring value to the bottom line of both owners and contractors was outstanding," said Andrea Pearman, Executive Director of NWIBRT.

Erick Dickey, Sullair Air Systems Expert and Andrea Pearman, NWIBRT Executive Director

have you Experienced nano?

"You and the crew are true professionals in the business and it makes things go smoothly!"

- A distributor in the Southeast

Experience. Customer. Service.
nano-purification solutions
support@n-psi.com
704.897.2182

INDUSTRY NEWS

Kent Van Sickle, Sullair Regional Sales Manager, Andrew Crowl, CompressAir President, Hal Rinkel, Sullair Product Manager, Eric Dickey, Sullair Air Systems Expert (left to right).

Sullair hosted the Incentive Program event in the auditorium and closed the day with a tour of the Michigan City Plant and facility. DOE AIRMaster+ Certified Kent VanSickle and Hal Rinkel, along with Eric Dickey of Sullair, presented on Air Auditing and the Sullair LogAir data logging system. They covered the costs associated with compressed air and the resources Sullair has available through their distribution network to assist end users in measuring current systems and identifying efficiency opportunities.

Carl W. Andre and Byran Zicherl, of Lockheed Martin, presented NIPSCO's current Commercial and Industrial Energy Efficiency Incentive Program and the rebate application process. Current incentives range from compressed air, HVAC, lighting, and more. They also covered how to become or connect with a Trade Ally partner to assist in finding and incorporating the measures for bids and current end user projects.

About CompressAir

CompressAir is the authorized distributor for Sullair in the Northern Indiana and Southern Chicagoland areas. They are also a NWIBRT member as well as a Lockheed Martin and ComEd Trade Ally. CompressAir has become a leader in the industry by providing a wide variety of options to help customers reduce operating costs and increase efficiency with their compressed air system. For more information please visit www.compressair.net.

About NIPSCO

NIPSCO's commercial, industrial and non-profit energy efficiency programs are administered by Lockheed Martin, a third-party implementation specialist that helps businesses save energy. For more information on NIPSCO's Commercial and Industrial Energy Efficiency Program, please visit NIPSCO.com/SaveEnergy.

About NWIBRT

NWIBRT is the largest association of owners, contractors, subcontractors and suppliers in Northwest Indiana. For more information please visit www.nwibrt.org.

Ingersoll Rand Expands Rental Fleet by 50 Percent

Ingersoll Rand®, a global leader in air compression technologies and services, has added 50 percent more compressed air rental equipment to its fleet in the U.S., Europe, Middle East, India and Africa. Ingersoll Rand rental equipment delivers reliable, temporary compressed air solutions for mid- to high-capacity manufacturing operations to keep critical processes up and running during emergencies or planned projects. The Ingersoll Rand rental fleet includes oil-free Class 0 and oil-flooded air compressors ranging from 20 horsepower/15 kW to 400 horsepower/300 kW, as well as refrigerated and desiccant dryers.

"Ingersoll Rand is a true one stop shop for customers requiring any compressed air solutions, whether that is a permanent or temporary air compressor or dryer," said Eric Seidel, vice president of product management for air compression technologies and services at Ingersoll Rand. "Our expansive rental fleet gives customers peace of mind when they face a system failure or when they require incremental compressed air systems due to peak demand."

Maintenance service is included with all rentals, as well as Ingersoll Rand genuine parts including filters, lubricants, fluids, spare parts and consumables. Additionally, expertly trained Ingersoll Rand technicians manage the service, repair and maintenance of the compressed air rental assets.

Ingersoll Rand compressed air rental services provides solutions for:

- Unexpected Equipment Failure: A rental solution helps to maintain the air capacity needed to keep a process operational while the issues with the current system are being addressed.
- Planned Outages and Maintenance: During the system's plant upgrades,

COMPRESSED AIR *ALSO* PRODUCES OILY CONDENSATE*

Help ensure it doesn't impact our ENVIRONMENT.

Sepremium Oil/Water Separator

JORC Zero Air-Loss Condensate Drains and Oil/Water Separators provide SUSTAINABLE CONDENSATE MANAGEMENT

*A 250 hp compressor can produce 40,515 gallons of oily condensate per year.

Zero Air-Loss Condensate Drains

ELECTRONIC


Smart Guard Ultra


Smart Guard


Smart Guard Mini

NO ELECTRICITY REQUIRED


Mini Mag
Filter Applications


Mini Mag SP
Filter Applications


POD-TD
Receiver Applications

Compressed Air Saving Products


Air-Saver G2
Air Leak Lock-Down


Locator-EV
Ultrasonic Air Leak Detection

JORC
Global Focus on Condensate Management

JORC Industrial LLC. • 1146 River Road • New Castle, DE 19720
Phone: 302-395-0310 • Fax: 302-395-0312 • info@jorc.com • www.jorc.com

INDUSTRY NEWS

The Ingersoll Rand includes oil-free Class 0 and oil-flooded air compressors ranging from 20 to 400 hp, as well as refrigerated and desiccant dryers.

renovations or maintenance, facilities can use rental equipment to maintain continuous operations.

- Seasonal Peak Demand: Temporary, incremental equipment can be used to fulfill special circumstances requiring additional supply beyond the facility's existing compressed air capacity.
- Testing: Customers can use a rental to test a new product or temporarily run a production line.
- Tight Capital Budgets: Renting equipment can minimize the demands on cash flow and provides a viable solution for customers facing emergencies and cannot afford an unplanned investment.

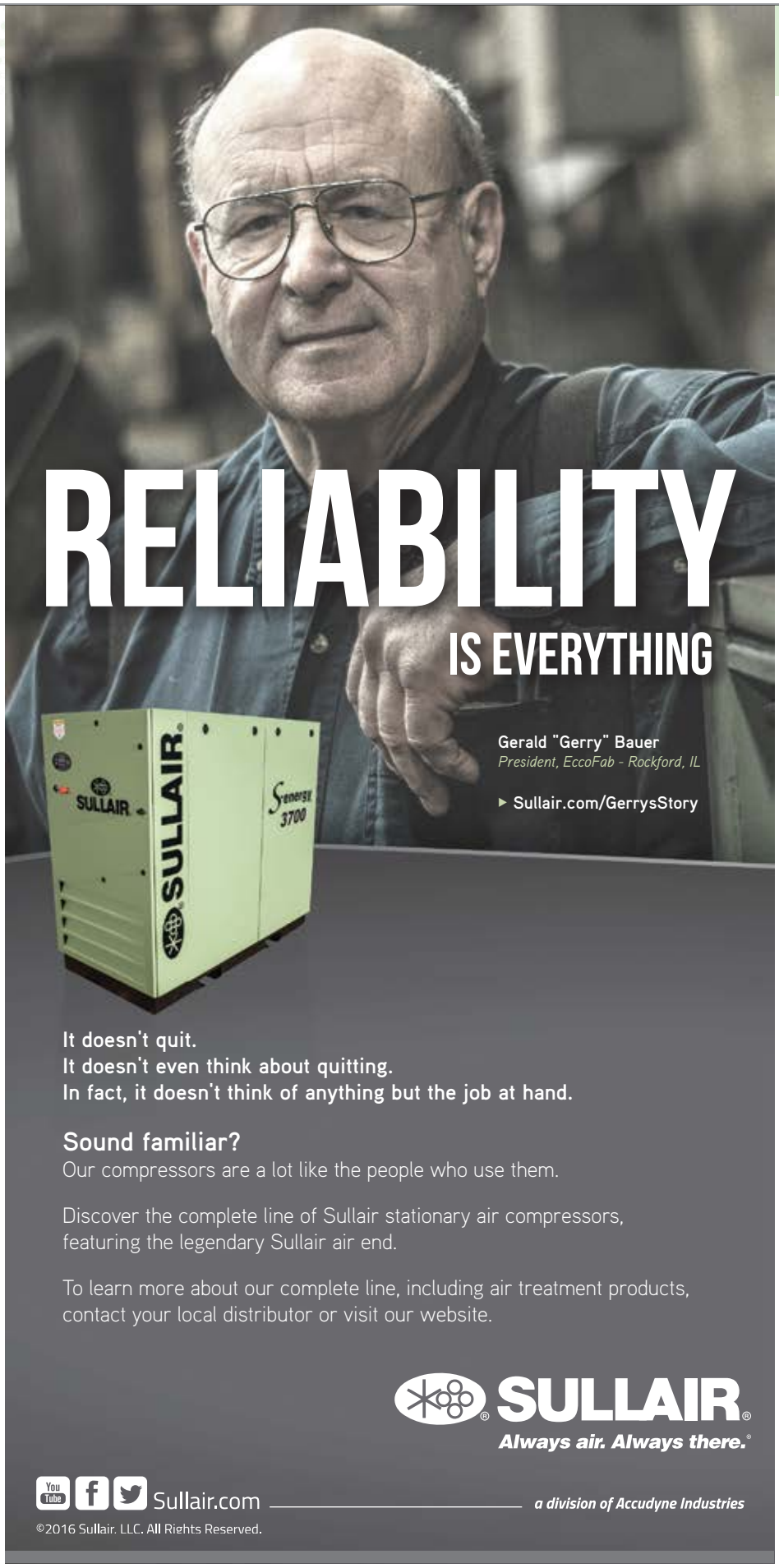
Ingersoll Rand systems engineers and technicians are available to work with customers to develop a contingency plan prior to a system failure to help reduce downtime and any financial losses by decreasing the time needed to identify, coordinate, connect and start temporary equipment. Contingency planning includes an evaluation of factors such as identifying weaknesses in the compressed air system, planning for scheduled maintenance and new equipment installation,

determining the type of temporary equipment needed, assessing equipment location, detailing electrical connection requirements and identifying emergency contacts to allow the complete process to go smoothly, in the least amount of time.

"Downtime during equipment failure can be devastating to a business, and the contingency planning can help facilities prepare for the unexpected," Seidel said. "Working with an Ingersoll Rand expert to create a contingency plan saves time and reduces downtime so rental equipment can be deployed quickly."

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.



INDUSTRY NEWS

Festo and Allied Electronics Ink Distribution Agreement

Festo, one of the world's premier automation companies, and Allied Electronics, a leading distributor of industrial automation products with North American headquarters in Fort Worth, Texas, inaugurated a national distribution agreement covering Festo actuators, fittings, solenoids, valves, and filters.

"Festo is recognized for its engineering, product quality, and support," said Frank Cantwell, Vice President of Product and Supplier Management at Allied Electronics. "With the new Festo North American Regional Service Center in Mason, Ohio, Festo gains forward product deployment. This helps lower distributor inventory requirements and makes a North American distributor like Allied more productive, competitive, and responsive to its customers. I am proud to say today we are distributing Festo products."

"Every Allied Electronics local branch, and they have 43, has an outstanding relationship with its customers and knows the needs of its local market," said Mark Snyder, Channel Director, Festo.

"Once Allied sales people experience the satisfaction their customers have with Festo products, sales will steadily climb. The new national distribution agreement is a win for customers, Allied Electronics, and Festo."

For more information on obtaining Festo actuators, fittings, solenoids, valves, and filters visit www.alliedelec.com or call the local Allied Electronics office at (800) 433-5700. For more information on Festo, visit www.festo.us.

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 delivering higher performing, more profitable automated manufacturing and processing equipment.

About Allied Electronics

Allied Electronics is a high-service level, authorized distributor of industrial automation, interconnect, cabling, and electromechanical products with sales offices serving the Americas. With more than 3.5 million parts online, engineers and purchasers often look to Allied for a broad range of product solutions from more than 300 world-class suppliers. Allied Electronics is a trading brand of Electrocomponents plc (LSE:ECM), the global distributor for engineers headquartered in Oxford, England.

Shanbhag Appointed President of Mikropor America

Mikropor America Inc. announced the appointment of Nitin G. Shanbhag as President of Mikropor America Inc.

"We are very excited for Nitin's addition and leadership to foster growth and increased customer focus in our American business unit,"

Mikropor America Inc. recently appointed Nitin G. Shanbhag as President.

NEW
Identify all savings.

The VPFlowScope in-line: Flow, Pressure and Temperature. All in one instrument!
Reveal leakage, shut off unused areas. Check consumption of air driven tools and production equipment. Identify costs, take action and save!
Three models: 0.5", 1", 2". Modbus, 4..20 mA, pulse. Optional display & 2 M point data logger.
Contact us today: e-mail sales@vpinstruments.com
VP INSTRUMENTS
www.vpinstruments.com
Measure | Manage | Improve

said Volkan Ayhan, Vice President Compressed Air Treatment, Mikropor Inc.

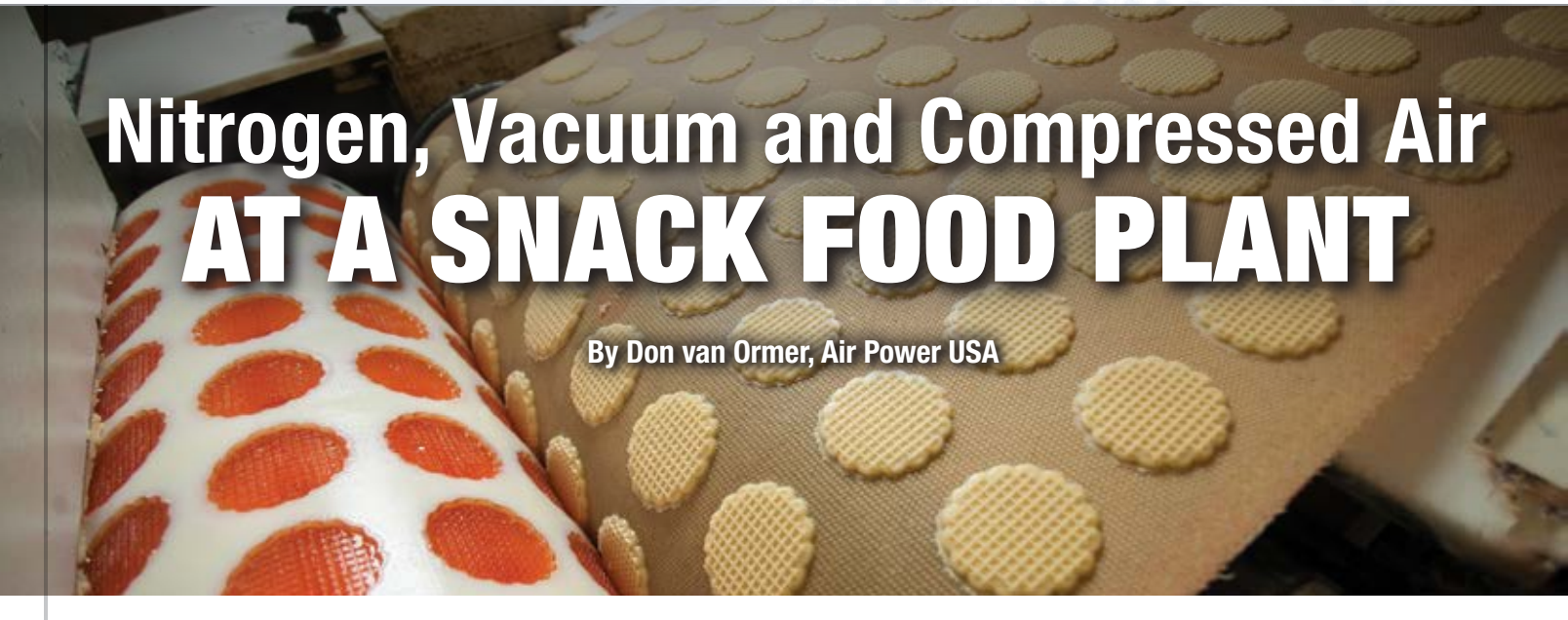
Shanbhag is a graduate engineer with twenty years experience in the compressed air industry, having held leadership positions in the areas of management, sales, marketing and product development in organizations such as Ingersoll Rand, Hitachi, and Boge Compressors.

"I am proud to join the Mikropor Team. Our innovation of solutions, with vertical integration, positions us well to assist a variety of customer needs," said Nitin G. Shanbhag, President, Mikropor America Inc.

For over thirty years the Mikropor name has been recognized as the "best in class" serving the industrial filtration markets, including air compressor equipment, compressed air purification, power generation, gas turbines, dust collection, clean room and HVAC. Mikropor proudly has over 600 employees and four world class manufacturing facilities in Ankara, Turkey. Mikropor is ISO certified, technology-driven and committed to engineering innovations satisfying customer expectations for product quality, reliability, and extreme value.

About Mikropor

Mikropor America Inc., headquartered in Michigan City, Indiana, is a subsidiary of Mikropor Inc. offering a broad range of engineered solutions for the compressed air industry such as: Refrigerated and Desiccant Air Dryers, Nitrogen Generators, Air/Oil Separators, Compressed Air Filtration, Air Intake Filters, Oil Filtration and aftermarket replacement filtration elements for compressed air. Founded in 2011, our 75,000 square foot facility was established to locally serve our North American customer base of Distribution and OEM partners. Mikropor America Inc. is also a member of the Compressed Air and Gas Institute (CAGI). For further information, please contact Mikropor America at (219)-878-1550 or visit us online at www.mikroporamerica.com.



Nitrogen, Vacuum and Compressed Air AT A SNACK FOOD PLANT

By Don van Ormer, Air Power USA

➤ Introduction

Annual plant electric costs for compressed air production, as operating today, are $141,998 per year. If the electric costs of $6,222 associated with operating ancillary equipment such as dryers are included the total electric costs for operating the air system are $148,220 per year. These estimates are based upon a blended electric rate of $0.08 /kWh.

This plant has three production lines producing snack food. Depending on the time of year and production demand the plant can operate anywhere from no production lines to all three production lines.

A thorough supply and demand-side system assessment was done at this plant. Due to article space constraints, this article will focus on some recommended demand-side reduction projects including nitrogen generation, air vibrators, leaks and vacuum venturis.

TABLE 1: OEM ENGINEERING DATA FOR EXISTING AIR COMPRESSORS

MANUFACTURER	ATLAS COPCO	ATLAS COPCO
Model	ZR 90	ZR 90 VSD
Unit Type	2-Stage Oil Free	2-Stage Oil Free
Type of Cooling	Water	Water
Full Load Nominal Published BHP	125	124
Full Load Pkg Horsepower (input)	132	142
Full Load Motor Efficiency (me)	.945	.945
Full Load Rated Pressure (psig)	105 psig	103 psig
Full Load (input) kW @ rated psig: Calculated	To adjust full load 100-psig class kW to reflect pressure up or down, multiply change in pressure x 0.005 = % up or down in kW (positive displacement compressors only)	
Cooling Fan Input kW	N/A	N/A
Total Input FL kW	104 kW	112 kW
Full Load Flow (acfm)	555 acfm	547 acfm
Full Load Flow (scfm)	511 scfm	503 scfm
Full Load Nominal Set Point (psig)	103 psig	103 psig
Type of Capacity Control	2-step	Variable Speed Drive
Pressure Control Band	103-113	±2
Idle kW	25 kW	30 kW
Full Load Specific Power (acfm/kW)	5.33 acfm/kW	4.88 acfm/kW
Annual Electric Cost ($/cfm) Full Load	$131.32 cfm/yr	$143.49 cfm/yr

Based upon blended electric rates of $0.08 per kWh and operating 8,760 hours per year.

Supply-Side Overview: Air Compressors and Dryers

The air compressors have all operated reliably and have met expectations. There are two Atlas Copco, water-cooled, oil-free, rotary screw air compressors producing the compressed air for the system demand. One is a model ZR 90,125-hp class (132 bhp) producing 511 scfm at full load and equipped with a 2-step unloading control. It is used as a base load compressor when needed for higher production levels.

The second Atlas Copco model ZR 90 VSD, 125 hp class (142 bhp) produces 503 scfm at full load. This variable speed drive (VSD) air compressor is used as a trim compressor, when high production levels occur, and as a base load unit during lower production periods. This air compressor seldom reaches full load during lower production levels.

The plant also has an Ingersoll-Rand model 1CV12M2, 250-hp class, 2-stage, water-cooled, centrifugal air compressor used as emergency backup or when the Atlas Copco compressors need service or repair.

The system has two Ingersoll-Rand model DXR 1250, water-cooled, refrigerated dryers to handle the air demand. During the hot

summer months, plant personnel operate both of the dryers due to increased condensate downstream found in production areas.

The Compressed Air System

The compressed air system is divided into two separate piping feed lines, one going to Plant Air and one to the Corn Transport and Nitrogen Generation areas. The Plant Air feed is regulated from an average discharge pressure of 97 psig to 88 psig; using a Zeks model 30X PC00 flow controller. The Corn Transfer and Nitrogen system are fed from the unregulated side of the system.

The compressed air system operates 8,760 hours per year. The load profile or air demand of this system is not stable during different production lines. The system pressure runs from 95 psig on the Nitrogen and Corn Transfer area to 87 psig in the headers during production - except on the Tortilla Chip packaging line due to inline regulators and filters in the sub header.

The Nitrogen Generation Area

The lines with the largest compressed air demand are the Corn Transport and the Nitrogen generation PSA unit.

The Nitrogen is used to purge the ambient air from the packaging bag before the chips are filled and sealed. The current Nitrogen generation system is a Parker / Balston PSA model DB8000- 0.5, which produces one scfm of Nitrogen for every 4.4 scfm of compressed air at 105 psig. The generator switches every minute and the compressed air flow rate is based on the Nitrogen demand and will vary with the number of production lines running. Liquid Nitrogen is supplied as make up if the generator cannot meet system demands.

N_2 is used on the Potato Chip bagger systems and not for the Tortilla Chip lines. When there

NITROGEN, VACUUM AND COMPRESSED AIR AT A SNACK FOOD PLANT

is no Potato Chip line running, the Nitrogen generator is shut off.

Plant personnel plan to install a new Nitrogen generator Parker model DB9000-B0503, which requires 383 scfm of compressed air at 85 psig to produce up to 150 scfm of Nitrogen. This newer generation nitrogen generator is more efficient and will help reduce the compressed air demand and have a more stable Nitrogen supply.

The increase in nitrogen generation efficiencies over the last decade have made on site generation even more effective compared to off-site generated supplies. Like many new trends, on site generation systems are frequently installed without full awareness of what the true operating cost is or what it could be. The major operating cost of on-site generated nitrogen is the compressed air.

- Nitrogen comes from air
- On-site nitrogen generation comes from compressed air through:
  - PSA Adsorption of nitrogen (purge oxygen)

TABLE 2: COMPRESSED AIR AND NITROGEN USE OF THREE PRODUCTION LINES

	CURRENT SYSTEM				PROPOSED SYSTEM			
System Comparison	No Production	Tortilla Chip #1	Tortilla Chip #2	Potato Chip/ Nitrogen #2	No Production	Tortilla Chip #1	Tortilla Chip #2	Potato Chip/ Nitrogen#2
Average Flow (cfm)	250 scfm	380 scfm	292 scfm	488 scfm	212 scfm	342 scfm	254 scfm	320 scfm
Compressor Discharge Pressure (psig)	97 psig	97 psig	97 psig	97 psig	85 psig	85 psig	85 psig	85 psig
Average System Pressure (psig)	88 psig	88 psig	88 psig	88-96 psig	85 psig	85 psig	85 psig	85 psig
Electric Cost per cfm	$12.25	$134.00	$129.47	$102.88	$11.05	$120.65	$111.09	$107.35
Electric Cost per psig	$15.32	$254.61	$189.03	$251.03	$11.71	$206.32	$141.09	$171.76

Compressor technology is in our DNA

Offering you the right technology for every application

Howden offers unparalleled experience and expertise in the most challenging applications, with unique skills and an unmatched reputation. In any sector, in every application where reliable, round the clock operation is paramount, Howden innovation and technology keeps the world's industries running.


SG integrally-geared compressor


Roots overhung inboard bearing compressor


Reciprocating compressors


Oil injected & oil free screw compressors


Roots integrally-geared compressor


Centrifugal compressors

For more information contact:

5825 North Sam Houston Parkway West,
Suite 250, Houston, TX 77086 USA
t: 1-800-55-ROOTS (76687)
e: compressors@howden.com

Revolving Around You™

www.howden.com

Howden

© Howden Group Ltd. All rights reserved. 2017

- Membrane Separation (purge oxygen)

- When you use more nitrogenpurity than required, compressed air costs are higher. The most significant operating energy cost is the delivery of the compressed air:
  - Compressed air is energy expensive: 8-hp of electricity produces only 1-hp of work with compressed air
  - Controlling the cost of nitrogen is controlling the volume and pressure of compressed air needed
  - *Important information required*
    1. Purity of N_2 requirement determines flow and pressure
    2. Know the ratio of CA/N_2 for each type of generator to meet identified N_2 flow, pressure and purity

- The most common nitrogen purity specification is 99.999% – safe for production, but expensive to generate.

RECOMMENDED PROJECT (#1):

Install new more efficient Nitrogen Generator to reduce the compressed air to nitrogen ratio from (4.4 to 1) to (2.5 to 1).

Current compressed air usage	300 scfm
Estimated compressed air usage with more efficient generator	170 scfm
Estimated compressed air savings	130 scfm
Total energy recovery project	$21,128 per year

Artificial Demand Background

The air system will be most efficient if it uses the lowest possible flow and the lowest effective pressure. Therefore, pressure regulators can be used to create effective use of the air receiver

www.klsummit.com

SUMMIT

Get expert advice from industry leaders

See all our Food Grade products:
klsummit.com/products

Benefits of Using Summit FG Elite Series

NSF ISO 21469 Certified

High Quality
Full synthetic, NSF H1 Registered, Kosher Approved, Halal Certified

Long-Life
Lasts between 8,000 and 10,000 hours in field tests, depending on conditions

Innovative Chemistry
Increased solvency helps reduce deposit and sludge formation

In the past, going with food grade lubricants meant sacrificing quality. Not anymore. *Meet Summit FG Elite*.

Summit FG Elite Series food grade compressor lubricants use 100 percent multi-synthetic base oils in combination with performance driven additives to offer extended lubricant life.

These lubricants are specially designed for rotary screw, vane, reciprocating air compressors and vacuum pumps used in the food service industry.

And of course, all our products are backed by our uncompromising service and continued expertise. We're a full service shop. Let me know how we can best serve you.

a brand of FREUDENBERG

Klüber Lubrication NA LP
903.534.8021 // info@klsummit.com

Proudly Presenting the 2017 Expert Webinar Series

COMPRESSED AIR BEST PRACTICES
airbestpractices.com

Nitrogen Use in Food Processing & Packaging

Join **Keynote Speaker,** Bruce Welt, Professor in the Agricultural and Biological Engineering Department at the University of Florida. His presentation is titled "Applications for Nitrogen in Food Processing and Packaging." Foods are comprised of energy rich organic molecules that are sensitive to oxidation. Displacement of oxygen using nitrogen is one of the most common approaches to protecting foods during processing and within packaging. This presentation will cover key applications for nitrogen in food processing and packaging.

Bruce Welt is a Professor in the Agricultural and Biological Engineering Department at the University of Florida.

Our **Sponsor Speaker** is David Connaughton, Product Manager of Industrial Gas Generation for Parker Hannifin Gas Separation and Filtration Division, whose presentation is titled, "On Site Nitrogen Generation vs Delivered Nitrogen." Most nitrogen is supplied by a third party gas company and manufactured at a factory. More and more users are choosing to reduce costs, improve the environment and take control of their nitrogen supply by making their own nitrogen. Learn how simple it is to install, operate and maintain a nitrogen generator at this informative presentation.

Receive 1.0 PDH Credit.

David Connaughton is the Product Manager of Industrial Gas Generation for Parker Hannifin Gas Separation and Filtration Division.

Register for Free Today at
airbestpractices.com/magazine/webinars
September 14, 2017 – 2:00 PM EST

SPONSORED BY:
Parker

NITROGEN, VACUUM AND COMPRESSED AIR AT A SNACK FOOD PLANT

capacity and maintain a stable air flow in the system at the lowest effective pressure. This avoids pressure spikes that can create increased flow to all unregulated air uses with no increase in productivity.

Artificial demand is air demand generated by excessive pressure or system overdrive that does not enhance productivity or quality. Other benefits of a "controlled system" include:

- Production should find a constant, steady pressure conducive to stabilizing demand and increased productivity. A steady, fixed pressure may also increase the quality of production runs by fixing the repeatability standards.
- Once the system is stabilized and the flow and pressure are controlled, plant personnel can experiment to find the lowest effective pressure, which will optimize flow demand.
- Properly sized demand-side control receivers and controllers may often carry a peak demand event over its operating time span without turning on or loading another compressor. Storage to cover certain identifiable larger demand "events" should be sized by calculation to cover the additional flow. Once sized, the decision will have to be whether to install the required storage in the compressor room or near the process.

Effect of Lower Pressure on Unregulated Flow

A plant's level of unregulated flow of 500 cfm at 100-psig pressure will automatically be reduced approximately as shown below for alternative pressure levels. This reduction is known as eliminating artificial demand or system overdrive. Sample savings include:

- Pressure reduction to 95 psig saves 25 cfm or 5 HP
- Pressure reduction to 90 psig saves 50 cfm or 10 HP
- Pressure reduction to 85 psig saves 75 cfm or 15 HP
- Full networking control systems and variable speed drive controls will also deliver a steady pressure to any system whose demand does not exceed the supply – this performance is not storage dependent

Current Application

Plant personnel have already installed a Zeks model 30X PC00, on the distribution header from the compressor room to production area, wet to 88 psig, the corn transfer and the Nitrogen generator are feed from a line before the flow controller. The current float is approximately 1 to 2 psi at the flow controller. We measured 87.7 psig at the PC packaging header and in other locations were similar in readings. This would indicate the main distribution header system is capable of handling the demand of the plant.

Storage Used to Convert High Peak Flow to Low Average Flow

The process at Corn Transfer has a short duration and a high peak flow of 427scfm over 2.25 minutes. This results in a "rate of flow" of 190 scfm during the period. The cycle time between peak surges is 15 minutes. Currently the plant has installed 4,200 gallons of receiver storage to handle this demand with a 1⁄4" orifice in the supply line to slow the refill rate of the receivers. In part, the projects listed are to lower the compressor / header discharge pressure from 90 to 85 psig. Additional storage will be needed to cover the peak demand with the lower pressure. An additional 2,500 gallon class receiver will need to be installed.

Establishing the Net Flow into the receivers during the process:

Pump up formula: Time = (volume) (P_2-P_1) / (Net Flow) (14.5)

2.25 = 561 (95-70) = 14,025 =
427 scfm NF (14.5) 32.85

Storage calculation for lower system pressure:

$$2.25 = \frac{\text{Vol. (85-70)}}{427 \times 14.5} = \frac{13{,}930}{15} =$$

928 cu ft x 7.48 (gal/cu. Ft) =
6,941 gallons – 4,200 = 2,741 gallons

Pump up time current storage:

8 minutes Tpu =

$$\frac{516 \text{ cuft } (25)}{\text{NF } (14.5)} = \frac{12{,}900}{116} = 111 \text{ scfm}$$

Pump up time recommended storage:

$$T_{up} = \frac{928(15)}{111(14.5)} = \frac{13{,}920}{1609} = 8.65 \text{ minutes}$$

The future refill rate for the new storage capacity will increase from eight minutes to approximately eight minutes and thirty nine seconds.

hertz
KOMPRESSOREN

Work With Us
Building The Future!

Our distributors and dealers in more than 130 countries have chosen us, because

Hertz Kompressoren is known for its Fast Response and Fast delivery

Hertz Kompressoren is known for its reliable, dependable, easy to use and simple service

Hertz Kompressoren is known for its collaborative and unique team

HERTZ KOMPRESSOREN USA Inc. 3320 Service St. Charlotte, NC 28206 USA // P: +1-704-579-5900 F: +1-704-579-5997

NITROGEN, VACUUM AND COMPRESSED AIR AT A SNACK FOOD PLANT

RECOMMENDED PROJECT (#2):

Install a 2,500 gallon class air receiver in the Corn Transfer area, tie into existing 4,200 gallon storage. This additional 2,500 gallons will provide enough storage for the process at the lower pressure of 85 psig.

Compressed Air Leak Survey

A partial survey of compressed air leaks was conducted at the plant and 8 leaks were identified, quantified, tagged, and logged. Potential savings totaled 24 cfm.

Number of leaks	8 leaks
Estimated reduction of air flow with proposed project	24 cfm
Recoverable savings from air flow reduction	$162.51 per cfm per year
Annual electric cost savings with proposed project	$3,900 per year
Unit cost of leak repairs ($25 materials per leak and $75 labor per leak)	$100
Total project cost (materials and installation)	$800

RECOMMENDED PROJECT (#3) Fix Compressed Air Leaks

Centralized Vacuum Supplies Box Erector and Packaging Area

According to plant personnel, all of the Venturi vacuum generators in the plant have been replaced with a central vacuum system. There are six Busch models MWK 1142 variable speed pumps, located in the Box Room.

TABLE 3: COMPRESSED AIR LEAK LIST

NO.	LOCATION	DESCRIPTION	EST. SIZE	EST. CFM
1	Compressor Room (Behind Compressor 2)	Leaking at push lock fitting on top of the zero loss drain	Medium	2.3
2	Bulk Klenzade (Defoamer)	Leaking at red hose connection to pump	Large	4.9
3	Processing Line 2 kettle A (upper level)	Push lock fitting leaking above kettle	Medium	2.4
4	Processing Line 2 kettle A	Push lock fitting under kettle	Medium	3.1
5	Bagging unit near post #15	Leaking at seal near bottom of regulator	Medium	3.3
6	Bagging unit near post #6	Regulator inside machine near bag roll.	Medium	3.0
7	Packing line 2	Hose reel (red) leaking	Medium	2.5
8	2nd Floor ACE 14	Leaking at pipe fitting for gauge	Medium	2.3
TOTAL				23.8

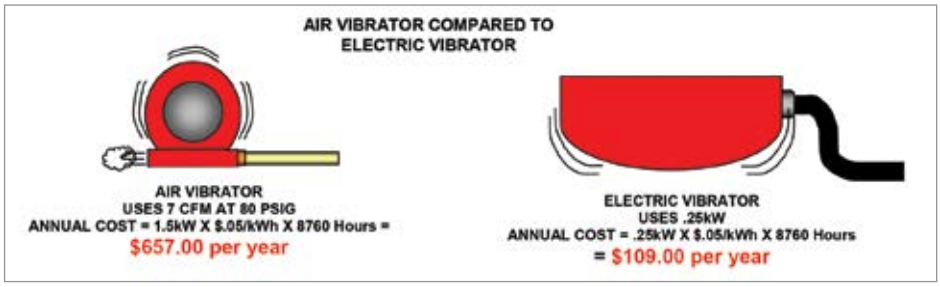


TABLE 4: LIST OF AIR VIBRATOR RETROFITS

	LOCATION	QTY	USAGE (%)	CURRENT AIR FLOW (CFM)	NET SAVINGS (AVG CFM)
#1	Corn Transfer Turbine	1	100%	7	7
#2	Corn Transfer Turbine	1	100%	7	7
TOTAL		2	100%	14	14

This system is more efficient than an uncontrolled air driven Venturi vacuum generator, which is what the box erector machines had been supplied with from the OEM. In general, if there is a large central vacuum system already in place and running with excess capacity, tying the vacuum generators requirement to it will probably generate energy savings.

Vacuum generators are selected for more localized or "point-of-use" vacuum applications that require smaller volumes and faster local response times. Manufacturers of production machinery often supply them as standard equipment. There are two basic types of ejector pumps: single-stage vacuum generators and multi-stage vacuum generators.

Single-stage vacuum generators use compressed air by accelerating the air through the restrictor tube to create a Venturi effect to evacuate the required volume of air. These single- stage Venturi generators are somewhat limited in their ability to fit many applications efficiently, since their basic design is set to accommodate either the highest flow or highest volume requirement. Typically, this type of vacuum generator has a ratio of compressed air consumption (scfm) to vacuum flow (the rate at which atmospheric pressure is removed from a system) of no better than 1:1 and sometimes as high as 2:1 or 3:1.

Multi-stage vacuum generators were developed to improve this efficiency for many applications. The multi-stage units use a series of ejectors and nozzles that allow compressed air to expand in controlled stages. This usually improves the ratio of compressed air consumption to vacuum flow to a level of up to 1:2 or more. Multi-stage units are also quieter.

The compressed air exits the smaller first pump nozzle creating a low pressure area at that stage. This low pressure creates a Venturi, pulling in the evacuation air through the ports. This evacuated air is mixed into the compressed air

flow. This action continues over succeeding stages. The flapper valve allows the compressed air to flow through the pump nozzles and not back into the vacuum.

In general, vacuum generators:

1. Use compressed air whenever they are on
2. Use less air and are more efficient when in a multi-stage configuration than they are as single-stage units under certain loads
3. Need to be carefully chosen – selecting the right pump for each specific application is not always easy
4. Are probably not the right approach when a large and/or continuous volume is called for
5. Will use a significant amount of compressed air when pulling a lower vacuum
6. Will waste a significant amount of compressed air when pulling a vacuum at any time it is not required for production
7. May be less economical than a "central mechanical" pump when there are a significant number of vacuum generators used in a single area.

Vacuum generators are very convenient and very responsive, but may be less efficient as applied compared to larger positive displacement pumps (e.g., larger rotary screw, vane, or reciprocating pumps), which may be the better choice when conditions require large flow, and allow potentially slower response time. They also may be very, very efficient and effective.

Energy cost escalates as the vacuum level goes down with Venturi generators, so it is very important to only run a Venturi vacuum generator at the minimum vacuum level (psia), minimum acceptable "on time" cycle, and at the lowest effective compressed air pressure. Properly applied, Venturi generators can be very power efficient and can enhance productivity.

Air Vibrators

Air vibrators are used to keep product or packaging moving or separated – e.g., keeping lids separated prior to sealing. If a plant employs air vibrators that use about 10 cfm each, they will require about 2.5 hp or more to produce the same as a similar electric vibrator, which might use about 0.25-hp input energy.

Air vibrators are used to keep product or packaging moving or separated – e.g., keeping lids separated prior to sealing. If a plant employs air vibrators that use about 10 cfm each, they will require about 2.5 hp or more to produce the same as a similar electric vibrator, which might use about 0.25-hp input energy. Air vibrators can almost always be replaced with electric except in foundry sand mold operations.

RECOMMENDED PROJECT (#4) – Replace two (2) air driven compressed air vibrators with electric units.

Compressed air used currently	14 cfm
Reduction in compressed air usage	14 cfm
Recoverable savings from air flow reduction	$162.51 cfm/yr
Total energy recovery project	$2,275 per year
Estimated cost of project	$1,000

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

Breath of Fresh Air

The cleanest oil-free compressors that protect your products, packaging and reputation!

"Class Zero Oil-Free Air"
All models meet ISO 8573-1 Class 0 for oil aerosol, liquid, vapor and silicone.

ECOPAK

Premium Efficient OIL-FREE Compressors
KNW Series
Proudly Made in the U.S.A.
1-800-394-6151
knw-series.com
Rogers Machinery Company, Inc.
KOBELCO KNW SERIES

Overhauling an Air Compressor: COST CONTROL, RIGOROUS TESTING AND QUALITY PARTS

By David Grabau, Ingersoll Rand Compression Technologies and Services

When an air compressor needs to be overhauled, you hope the experience will be as pain-free as possible. There are different approaches to overhauling an air compressor, and each has different implications related to cost, parts, service and performance.

How to Know When it's Time to Overhaul an Air Compressor

Knowing when to overhaul a unit is important, and there are certain signs indicating a unit needs attention. Performing routine fluid checks, taking oil samples and routinely checking for bearing vibration can unveil indicators suggesting an upcoming failure. Oil contamination with metal fragments usually indicates parts are wearing. It's also important to take notice of airend temperature increases. If internal air compressor temperatures go up, it's a good indicator the cooler may be failing.

Two Overhaul Options: Remanufacture or Rebuild

The rebuild approach to overhauling an air compressor typically takes place in the field, at the customer site, where the air compressor is already installed. The product testing after the rebuild occurs in the field and may include checking discharge pressure, vibration levels and testing for oil leaks. During a rebuild, existing parts are either refurbished or replaced with rebuilt or third-party parts.

A remanufactured air compressor is overhauled within the original equipment manufacturer's (OEM) factory. In this scenario, the factory will have all of the design drawings and specifications to bring the unit back to the original factory specifications. The

"Knowing when to overhaul a unit is important, and there are certain signs indicating a unit needs attention. Performing routine fluid checks, taking oil samples and routinely checking for bearing vibration can unveil indicators suggesting an upcoming failure."

— David Grabau, Ingersoll Rand Compression Technologies and Services

manufacturer may build the replacement airend with in-house parts, replacing bearings, seals, gaskets, pumps and more with new or OEM-certified parts. They will also conduct a complete mechanical and performance test before the unit leaves the factory.

Considerations When Choosing an Overhaul Option

The bid for an overhaul often starts with a low initial price including basic parts and services. However, as the disassembly and inspection process gets underway, additional items are often worn or broken. The price and scope of the overhaul can change with the addition of each item. Without a fixed-price guarantee, additional parts and labor can quickly add up.

A successful overhaul can be evaluated by assuring the unit makes discharge pressure, the vibration levels are reasonable and the unit isn't leaking. These standard measurement protocols include: delivering the rated capacity at the specified discharge pressure with "as new" efficiency and ensuring the surge pressure meets new equipment standards. The unit can be tested to determine it is leak free and the stage and bull gear vibration levels meet new equipment specifications. The air cooler performance should match new equipment requirements. While these are good

It is important to take notice of airend temperature increases. If internal air compressor temperatures rise, it is a good indicator the cooler may be failing.

BOGE
COMPRESSED AIR SYSTEMS

BOGE AIR. THE AIR TO WORK.

Best
Of
German
Engineering

SLF Series: VDF Compressors
Quiet · Direct Drive · Efficient

For more information on our complete product offering please contact us:

Phone +1 770-874-1570
www.boge.com/us

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

Learn How To Save Energy & Improve Productivity In YOUR Industry!

Subscribe Now!

Subscribe at
airbestpractices.com

OVERHAULING AN AIR COMPRESSOR: COST CONTROL, RIGOROUS TESTING AND QUALITY PARTS

things to measure, there are many other things one can test to ensure a high standard of quality and reliability.

A company with in-house stock units allows the customer to plan in advance for their air compressor overhaul. For example, they can overhaul a unit within their factory, while the customer leaves their existing air compressor running until the exchange unit arrives. This eliminates downtime and disruption.

Testing Overhauled Air Compressors is Critical

Testing overhauled air compressors to meet rigorous specifications and standards is a crucial step in the process because it will ensure the unit meets the original quality benchmarks.

Benefits from testing air compressors include:

- Validation of the mechanical integrity of the machine
- Proof the machine was returned to like-new efficiency
- Minimization of uncertainties and field issues

Without completely testing the unit before it's started up at the customer site, it is impossible to know if the air cooler performance meets new equipment standards. You won't know if the unit will have the correct oil pressure or even if the air compressor is completely air, oil and water leak-free. This is a particular challenge when an overhaul is completed at the customer site, as they may not have the necessary testing equipment to ensure the unit is returned back to the original specs and tolerances.

The following is an example of the importance of testing. A large U.S.-based equipment manufacturer had an air compressor rebuilt by a company previously doing a field overhaul. They were curious to see if the unit still met the original performance and efficiency rating, so they contracted a company to test the unit. The testing revealed the throttle range of the trim air compressor had decreased by over 80% from factory specifications. This resulted in unwanted bypass and wasted energy consumption. Based on the test findings, the customer had the original manufacturer overhaul the air compressor back to its original performance capabilities. In doing so, the customer was able to reduce their operating costs and energy consumption.

Price Perception isn't Necessarily a Reality

When comparing two quotes, there is an expectation the lower quote will ultimately save money. But without a fixed price, there is no way to control costs and no guarantees. It's not uncommon for overhaulers to quote an initially low price. Unfortunately the costs often increase as additional issues are discovered during the teardown and inspection process. Of course, this results in more repairs, parts and service labor not part of the original quote.

With a fixed, upfront quote and complete scope of work, there are no additional costs to take into account, including the typical added cost overruns, potential customer downtime and possible onsite productivity loss. This can easily make up the cost differences. With a fixed price and scope of the air compressor overhaul, there is no need to go back and forth with purchase order revisions or additional purchase order requests.

A Contingency Plan Will Help Avoid Emergencies

There are many advantages to a comprehensive contingency plan in the event something unforeseen happens.

A contingency plan should cover many areas, such as a risk assessment identifying potential interruptions, ranking them according to cost impact, probability of occurrence and system downtime. A financial risk analysis can review all areas of the facility and their dependence on compressed air equipment to determine the financial impact of a failure. An air compressor overhauler should be able to help plan for future emergencies. Having a contingency plan can help:

- Reduce the risk of financial loss
- Eliminate the risk of production downtime and loss
- Reduce delivery time by completing paperwork ahead of time
- Make employees aware of their roles
- Identify weaknesses in the compressed air system
- Plan for scheduled maintenance and new equipment installation

All Parts are Not Created Equal

Air compressor rebuilders rely on rebuilt or third-party parts; thus, the reliability and performance of the overhauled air compressor may adversely impact production. This can occur when an inferior part fails or if the air compressor exhibits inefficient performance slowing productivity.

Recently, tests conducted on air compressor coolers supplied by an aftermarket part supplier found many deficiencies in the product's design and performance, most notably, the Cold Temperature Difference (CTD) performance and build integrity. It's important to remember CTD manufacturers design and test their coolers. Third-party parts offer no control over the product's quality or adherence to specifications and tolerance requirements.

The quality of the work and parts used by companies performing air compressor overhauls will have a direct impact on the unit's longevity and its ability to perform efficiently.

Questions to ask the overhaul company include:

- Do they use refurbished or third-party parts?
- Do they use new and OEM certified parts?
- Are they installing completely new bearings, seals, gasket kit, probes, pump and coupling hub?
- Are they conducting extensive mechanical and performance testing?
- Can they ensure the unit is within the manufacturer's tolerances and specifications? BP

For more information contact David Grabau, Remanufacturing Portfolio Project Manager, Ingersoll Rand, email: David.Grabau@irco.com or visit www.ingersollrandproducts.com.

To read more ***Air Compressor Technology*** articles visit www.airbestpractices.com/technology/air-compressors

MASTER CONTROLS for Multiple Air Compressor Systems with VFD Compressors

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

➤ Introduction

I made the case, in my last article, about how sizing a VFD air compressor, in a multiple-compressor system, is important to get right. So now when a system has the right combination of VFD and base-load air compressors, how do you coordinate their control? What tells the air compressors to run and load, to have just enough (or no) base-load air compressors and a VFD running, all the time air is needed? Appropriate master controls are needed. These controls are often called "sequencers" or "master control systems".

Air compressor sequencers have been around since pressure switches were invented. Sequencers were electro-mechanical cam-timer driven systems switching the pressure switch an air compressor would be controlled by. If there were three air compressors, there were three pressure switches, set in a "cascade" manner, and the sequencer merely pointed a pressure switch at an air compressor. They work like this: as pressure drops, the next air compressor starts and loads, and then the next one starts and loads if pressure drops further. As pressure rises, the reverse occurs. The last

> "To provide robust and efficient master control for a multiple air compressor system with a VFD compressor, understand VFD control, get the right kind of master controller, understand how it works, prepare well, interface correctly and test thoroughly."
>
> — Tim Dugan, P.E. President, Compression Engineering Corporation

one on will load and unload once the number of air compressors running stabilizes.

Then came programmable logic controllers (PLCs), basically automating the function. They still effectively are being virtual pressure switches. The smarts are in figuring out how many air compressors should be running, and to only trim one, without using a cascade arrangement. Some of these controllers are called "master controllers", or "management systems".

The goal of this article is to give some pointers for selecting and installing the right master control system for systems with one or more VFD air compressors.

Summary

In a nutshell, I recommend the following type of master control logic, or "algorithm", when a VFD air compressor is added to a multiple air compressor system:

1. Understand PID vs. Discrete Control
2. Ensure All Compressors Have Common Sensing Location
3. Set up Compressors to Accept Remote Commands
4. Select Proper Control Algorithm
5. Test, Tune and Measure

Understand PID vs. Discrete Control

VFD air compressors have OEM-engineered "PID" (proportional-integral-derivative) control, or a subset of it. Proportional control is the varying of a control variable based on the error between set point and actual process variable, to cause the process to come in line with the set point. In other words, if you set the VFD to control for 100 psig, and the pressure is 99 psig, you would "push" the VFD half as hard as if it was at 98 psig.

Integral control is for correcting longer-term events, like after a base-load air compressor unloads and the VFD is spooling up to catch the system, and pressure dips below its target briefly. Like steering a ship against a side-wind, the controller steers the pressure back up to the target. It is used to get the compressed air system back into the target where it needs to be. Derivative control is for "damping" the system based on fast changes in system pressure, minimizing overshoot and undershoot.

The master controller merely sends a set point to the VFD air compressor controller and lets the controller manage speed control. It should be able to over-ride and start or stop the air compressor as well. PID control is sometimes referred to as proportional control.

In a system with a VFD trim air compressor sized correctly, the base-load air compressors should be simply controlled start/stop, by discrete control, or by a relay contact closure or opening. When the base-load air compressor is needed, it needs to auto start and load, on command from the master controller. When it is no longer needed, the master controller fully unloads it, waits for the VFD air compressor to respond and the pressure to stabilize and then shut it off. It takes two contacts, load and start.

Base-load air compressors are sometimes controlled locally by some form of proportional control, like inlet modulation or variable displacement. However, unless these controls are managed by the sequencer as a trim air compressor, and most can't (they are usually not electronically controllable), they

Pure-Aire

C SERIES
BEST IN CLASS!

UNPARALLELED RELIABILITY AND PERFORMANCE

The Pure-Aire C Series raises the bar for reliability while maintaining the lowest total cost of ownership and maximizing productivity. Cool Force™ technology ensures a consistent dew point is held under 40°F.

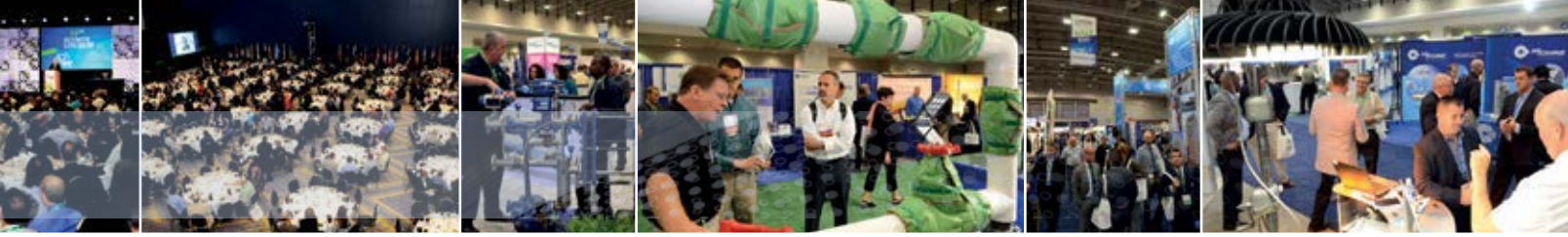
DESIGNED TO OUTPERFORM ANY REFRIGERATED DRYER AVAILABLE!

CONTACT US TODAY!

Scott Woodward
Regional Sales Manager
Phone: 1-800-274-3233
E-mail: sales@pure-aire.com
www.pure-aire.com

Proudly Engineered, Assembled, and Supported in the USA

DRYERS • FILTERS • FLOW CONTROLLERS • COOLING SYSTEMS



CONFERENCE - SEMINARS - TRADE SHOW

2017 WEEC
World Energy Engineering Congress
40 Years

September 27-29, 2017

Georgia World Congress Center, Atlanta, Georgia

WEEC Featured Special Guest
President George W. Bush

Energy, Power and Facility Management, and Sustainable Energy Solutions Expo

Join business, industrial and institutional energy users at the largest energy conference and technology expo in the U.S.

www.energycongress.com

Presented By

40 Years AEE®
Association of Energy Engineers

Other Energy Events

ATTENDANCE | 770.447.5083 x226

SEMINARS | 770.925.9633

EXHIBITS | 770.279.4392

EXPO 2018
GLOBALCON®
Energy, Power & Facility Management, Strategies & Technologies

www.globalconevent.com

EXPO 2018
WestCoast EMC®
Energy Management Congress

www.energyevent.com

MASTER CONTROLS FOR MULTIPLE AIR COMPRESSOR SYSTEMS WITH VFD COMPRESSORS

will be dialed-out and "discrete" controls are used. If you have a variable displacement control air compressor you want to put in trim position, and there is a way to communicate the set point remotely to the air compressor, it could be controlled similarly to the VFD air compressor.

Ensure All Compressors Have a Common Sensing Location

A frequent mistake in adding a VFD air compressor is to install it by itself with its own dryer. The problem is the VFD responds to pressure it sees, on the front of the dryer, different than downstream pressure, as seen by the rest of the system. If the other air compressors are put on a sequencer, the VFD can't be synchronized to work in concert with them. This will cause unstable operation. When the VFD ramps up, it creates a dramatically higher pressure drop across its dryer than at low speed and the pressure on the backside will dip. Other air compressors will start and load when not needed, and then the system will back off and do the opposite, back and forth.

Figures 1 and 2 show the wrong and right way to add a VFD air compressor to a multiple air compressor system. One merely needs to add a "wet" crossover line and then control at either the common wet or common dry side. I prefer wet side control, because the air compressor displays all indicate pressure at the location of their pressure transmitters – the package termination point, and most OEMs don't like moving the pressure transmitter to downstream of the dryer. One can certainly make a good argument for controlling the system on the dry side, but your local and remote pressures will

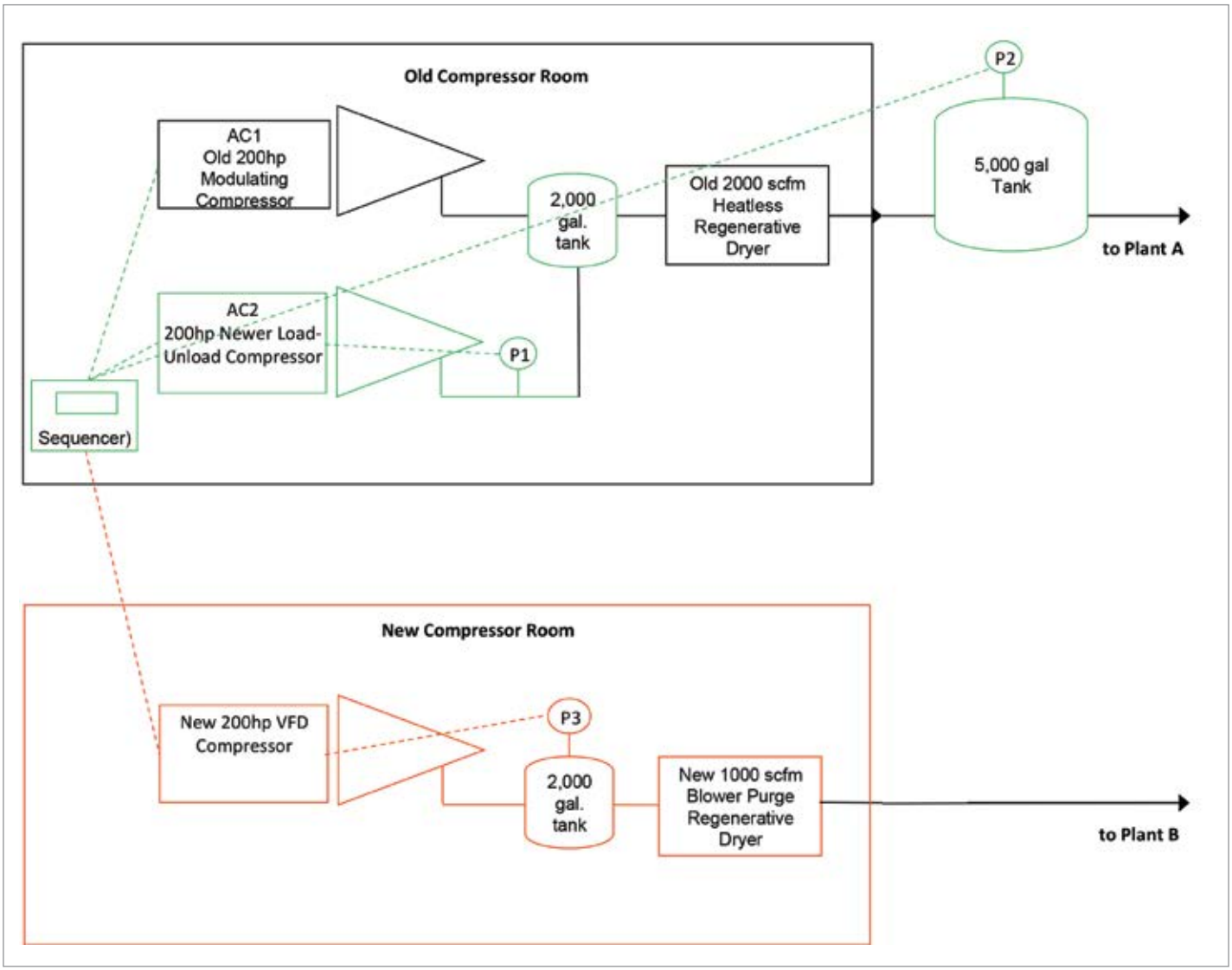


Figure 1. Poor implementation of a new VFD air compressor

MASTER CONTROLS FOR MULTIPLE AIR COMPRESSOR SYSTEMS WITH VFD COMPRESSORS

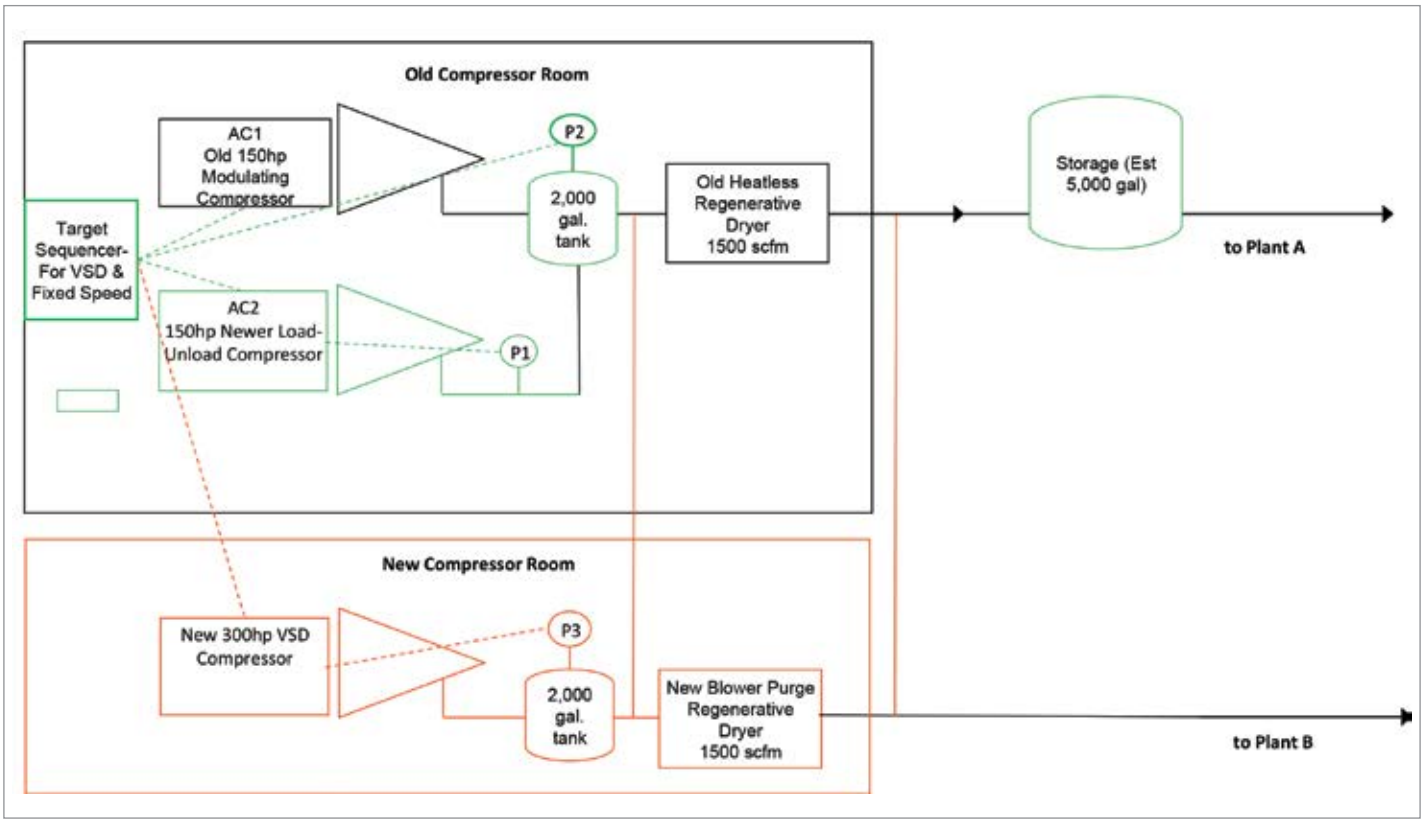


Figure 2. Good implementation of a new VFD air compressor

not be the same and the difference will wander based on filter pressure drop.

Set up Air Compressors to Accept Remote Commands

Let's start with the VFD air compressor. One of the biggest challenges I have run into when implementing master controls with a VFD air compressor is difficulty in integration. The VFD air compressor is either not set up for remote control, or there is not technical support to do it properly. The master controller supplier or outside consultant needs to work with the air compressor vendor prior to start-up to determine the following:

- Control wiring. What type of interface? RS485 or Ethernet? Modbus RTU or TCP? Ethernet or IP? 4-20 mA? What terminals to wire to?

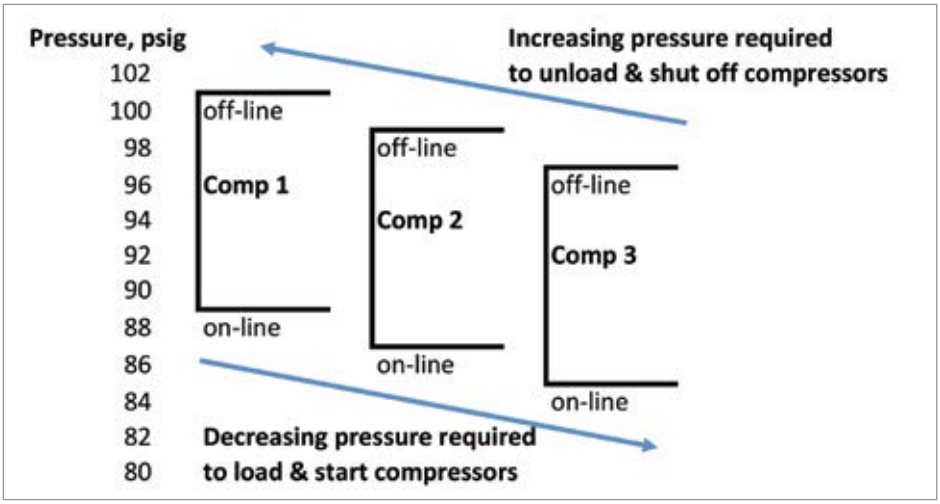


Figure 3. Cascade Algorithm

- Registers. What discrete registers are used for set point, start, stop, running, load, unload and alarm? What floating point registers are used for speed and power (if power is available)?
- Access. Password and instructions to set controller to accept remote commands/over-rides.

Some air compressors use proprietary communications protocols, and need a converter/interface board to be added so a third-party master controller can interface with them.

The base-load air compressors might be newer units with electronic control panels. If so, all the same questions need to be answered for them as well, except for the floating point numbers. If they are older electro-pneumatic control, they probably need wiring modifications to be controlled remotely, including:

- "Local-remote" switch and light.
- Load inputs from remote dry contacts
- Start inputs from remote dry contacts
- Relays with dry contacts for running, alarm and "remote" status.

An electrical schematic needs to be sent to the master controller vendor or consulting engineer in advance, so they can provide a wiring modification schematic and parts.

Select Proper Control Algorithm

This is an interesting step, since most of the people selling sequencers don't know what the "control algorithm" is for their sequencer. Just put in the box, run a cable to each air compressor, and it will learn and tune itself. This is Industry 4.0! All controllers have an algorithm, and for screw air compressors will be one of three, as far as I have experienced:

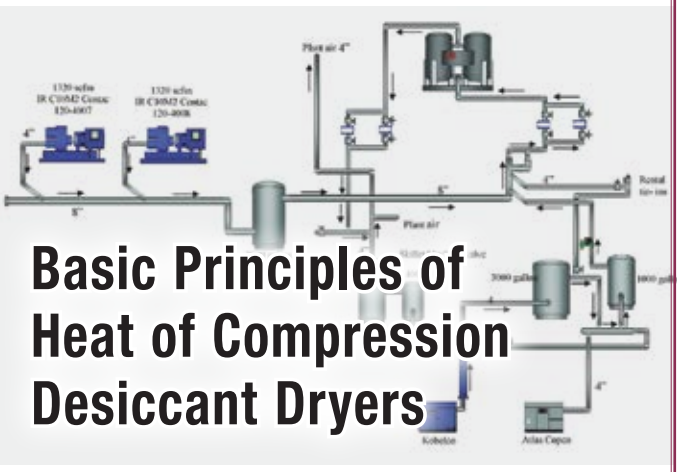
1. Cascade algorithm. I covered this in the introduction. This works fine for all load-unload air compressors, but should be avoided for systems with a VFD air compressor. Your VFD will be off or running at full speed much of the time. The last air compressor on is the trim air compressor, and they are rotated. See Figure 3. In the illustration, the pressure range for three compressors is 16 psig, from 84 to 100 psig. The cascade algorithm is the old standard for sequencers, so ask your supplier how their "sequencer" works before you purchase one for use with a VFD air compressor.

2. Target algorithm. This is the one to use with a properly sized VFD air compressor. The VFD air compressor speed control is set in the middle, or "target", and the base-load air compressors "bracket" it. They operate with one or multiple pressure windows, fully bracketing the VFD. See Figure 4.

This system can operate in less than 8 psi overall pressure range, depending on storage and tuning. Timers are set in the master controller so only one base-load air compressor starts/loads or unloads at a time, and the VFD is given time to respond. Base load

Proudly Presenting the 2017 Expert Webinar Series

COMPRESSED AIR BEST PRACTICES
airbestpractices.com



Basic Principles of Heat of Compression Desiccant Dryers

Join **Keynote Speaker,** Hank van Ormer, Founder of Air Power USA, to examine when a Heat of Compression Desiccant Dryer can optimize a compressed air system. Heat of Compression Desiccant Dryers accomplish desiccant regeneration through the heat generated during compression. Different compressed air systems, dew point applications, and discharge temperatures will be analyzed to determine the suitability and energy-savings potential of this dryer type.

Hank van Omer is the Founder of Air Power USA.

Our **Sponsor Speaker** is Chuck Henderson, Vice President of Henderson Engineering Company, whose presentation is titled "Energy Efficient Heat of Compression Dryers." He will discuss the basic principles and benefits of Heat of Compression technology within low dew point applications. This presentation will also demonstrate how to properly size and optimize this dryer type within different compressed air systems and manufacturing scenarios.

Chuck Henderson is the Vice President of Henderson Engineering Company.

Receive 1.0 PDH Credit.

Register for Free Today at
airbestpractices.com/magazine/webinars
November 9, 2017 – 2:00 PM EST

SPONSORED BY:

MASTER CONTROLS FOR MULTIPLE AIR COMPRESSOR SYSTEMS WITH VFD COMPRESSORS

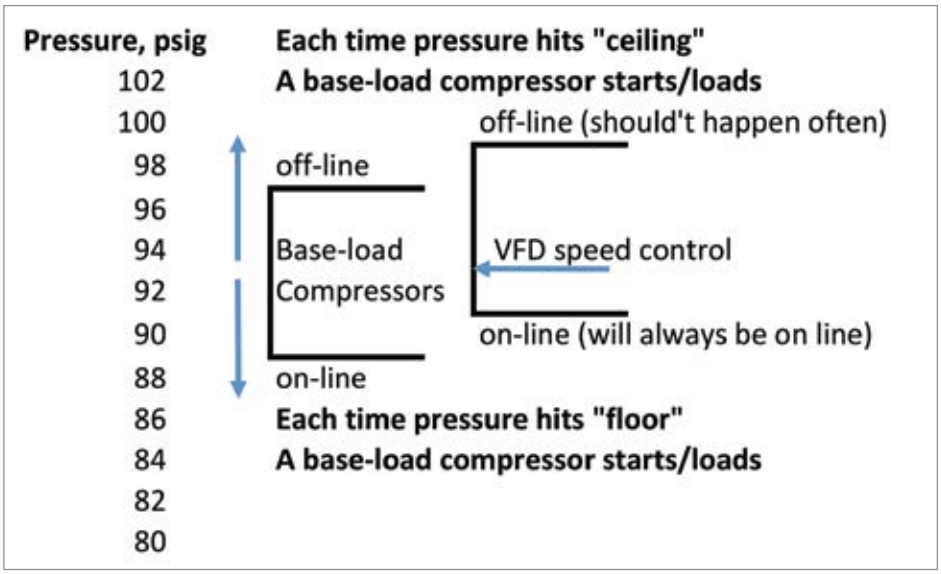


Figure 4. Target Algorithm

FLOW, ACFM	BASE-LOAD 1	BASE- LOAD 2	TRIM	BASE-LOAD FLOW	TRIM COMP FLOW
3750	150hp	300hp	VFD	2250	1500
3500	150hp	300hp	VFD	2250	1250
3250	150hp	300hp	VFD	2250	1000
3000	off	300hp	VFD	1500	1500
2750	off	300hp	VFD	1500	1250
2500	off	300hp	VFD	1500	1000
2250	150hp		VFD	750	1500
2000	150hp		VFD	750	1250
1750	150hp		VFD	750	1000
1500			VFD		1500
1250			VFD		1250
1000			VFD		1000
750			VFD		750
500			VFD		500
250			VFD		250
0			VFD		0

Figure 5. Flow-based Algorithm

air compressor starts and stops should be infrequent. Not all "target sequencers" can control a VFD air compressor in the proper way. Many of them require the VFD to be set separately from the sequencer itself. This is not ideal. It is best to put the set-point control of the VFD under the control of the master controller, and then the other air compressors will work in concert. And to adjust the system, you merely change the "target".

3. Flow-based algorithm. This is merely a way to run the right base-load air compressors at any time, to accommodate a larger sized base-load air compressor than is ideal. Suppose the two base-load air compressors in Figure 2 were 150 and 300hp, not 150hp each. And the only addition was one 300hp VFD air compressor. A target control algorithm, with constraints on when to run the 300hp, could work. We are aware of a couple controllers on the market including some form of flow-based decision in controlling base-load air compressors. Pneu-Logic PL4000 and AirLeader are two we have confidence will work in this way.

Test and Tune

No control algorithm will tune itself, no matter how sophisticated it is. I tend to prefer simpler algorithms with known "knobs" for tuning. Usually, these are the pressure bands and timers. One needs to test the installed system at peak and minimum loads, and in transitions between them, both slowly and quickly. Preferably with fine-sample data-logging occurring, so data can be reviewed and specific tuning parameters changed.

Conclusions

To provide robust and efficient master control for a multiple air compressor system with a VFD compressor, understand VFD control, get the right kind of master controller, understand how it works, prepare well, interface correctly and test thoroughly. BP

For more information, contact Tim Dugan, tel: (503) 520-0700, email: Tim.Dugan@cmop-eng.com, or visit http://compression-engineering.com.

To read more ***Air Compressor Control*** articles visit www.airbestpractices.com/system-assessments/compressor-controls

COMPRESSED AIR

BEST PRACTICES

airbestpractices.com

FREE SUBSCRIPTION

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

Learn How To Save Energy & Improve Productivity In YOUR Industry!

Subscribe at **airbestpractices.com**

Subscribe Now!

Metal Fabricator Keeps COMPRESSED AIR DEMAND LOW

By Ron Marshall, Marshall Compressed Air Consulting

Enduron (www.enduron.net) is a family-owned metal alloy fabricator located in Winnipeg, Canada. The company specializes in fabrication of precision assembled customized parts for OEM's and system integrators. Since 1997 the company has steadily grown in size and capacity as the demand for its high quality fabrications has increased. Through the years, many new CNC machines, laser cutters and powder coat painting operations have been added, but with all the expansion the facility has amazingly kept the plant compressed air consumption low. This has been achieved by following excellent "best practice" compressed air efficiency principles and by keeping watch on system waste. The regular use of ultrasonic leak detection and flow metering equipment has kept leakage levels low, and has even yielded some surprising results in some areas unrelated to compressed air.

Background

Richard Klassen, the company President since 1997, first contacted the local power utility Manitoba Hydro about his compressed air system in the in 1999. "When Manitoba Hydro first advertised the Power Smart program and offered to come in and show us how to reduce our energy consumption, it seemed too good to be true. Why would a company try to reduce its

> "Even with all the expansion, the facility has kept the plant compressed air consumption amazingly low by following excellent best practices in watching out for system waste."
>
> — Ron Marshall, Marshall Compressed Air Consulting

sales?" said Klassen. "I tried them anyway, and found they keyed in pretty quickly on easy ways to save energy. They showed us how we could use our existing air compressor equipment better and start saving money right away. That was over 15 years ago."

At the time, the compressed air system consisted of two small 10 hp reciprocating compressors. Both were maintenance headaches. The plant load had increased to the point the compressors were regularly exceeding the maximum rated duty, causing low pressure events, and these units were often overheating. The hot, oily air the machines produced was difficult to dry and filter, causing air quality problems in the plant.

It was decided the plant compressed air system would require an upgrade and capacity increase. After checking with suppliers, a small 30 hp lubricated screw compressor was selected with a similar sized cycling refrigerated air dryer. "We outgrew our compressor, and when we upgraded I made the mistake of not consulting with Manitoba Hydro when buying a new compressor," said Klassen. "The result was plenty of capacity, but a much higher cost of operation."

Findings

After the installation, Manitoba Hydro was invited in to assess the efficiency of the new compressor. Data loggers were placed to measure and calculate the system power input, and the resulting plant pressure levels. From these measurements a system auditor was able to determine the system was consuming about 253,000 kWh or almost five times the consumption of the previous reciprocating compressors, accounting for 40% of the total plant electricity consumption.

These results were unexpected, but not uncommon in systems converting from

This VSD air compressor varies the speed of the internal screw to match the flow output to the load.

Compressed Air Monitoring

ProAir 2200

Process Air Compressed Airline Monitor

- Continuous real-time monitoring of compressed airlines
- Can be custom configured with up to 4 sensors
- Can monitor a variety of hazardous gases present in compressed air including CO, O_2, dew point, CO_2, VOCs and trace hydrocarbons

CO-GUARD

Respiratory Airline Monitor

- Continuous CO monitor for compressed breathing air
- Easy to install, low maintenance
- Simple push button operation
- User programmable alarms & relays

- **Monitoring compressed air in manufacturing processes**
- **Monitoring supplied breathing air**
- **Monitoring medical compressed air systems**
- **Meets OSHA Grade D breathing air and NFPA-99 requirements**
- **Can custom design compressed air monitors for OEM applications**

ENMET
Creative Gas Detection Solutions
www.enmet.com 1-800-521-2978

METAL FABRICATOR KEEPS COMPRESSED AIR DEMAND LOW

reciprocating to screw compressors, especially systems having lightly loaded screw compressors running in inefficient control modes. The explanation of the reason for the change is shown in Figure 1. This is a simplified power vs. flow curve of various air compressor control types. The previous compressors were running in start/stop mode. This mode has a very linear power turn down when the compressors produce flows below their rated capacity. The new compressor, however, was being run in modulation mode, the least efficient way a lubricated screw compressor can run (Figure 2). "After the assessment Hydro came in again and showed us how an oversized surge tank and regulator valve could get our costs down again. We did not make the same mistake when we upgraded the next time," said Klassen. "They helped us understand what was new, what was working, just as important, what technologies were reliable in our environment. He also suggested we separate the air system into zones and install shutoff valves to isolate leaks quickly."

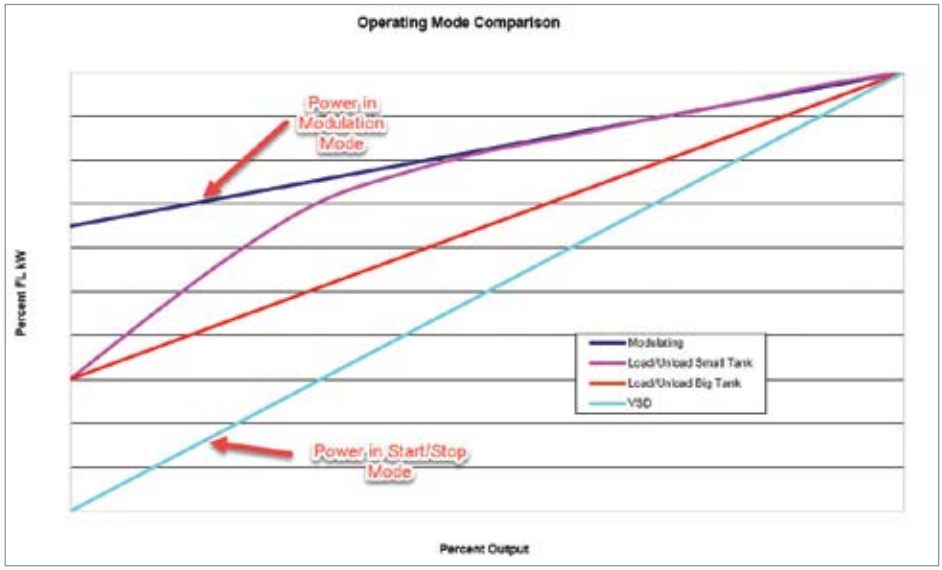


Figure 1: Energy input for reciprocating air compressors in "Start/Stop" mode is much lower than modulation mode.

Energy Projections

The energy auditor reviewed the data and found savings could be gained if the compressor control mode was changed to load/unload. However, before this could be done some extra storage receiver capacity needed to be added. As seen on Figure 1 the power curve for load/unload operation with a small tank is not much more efficient than modulation mode. The auditor recommended

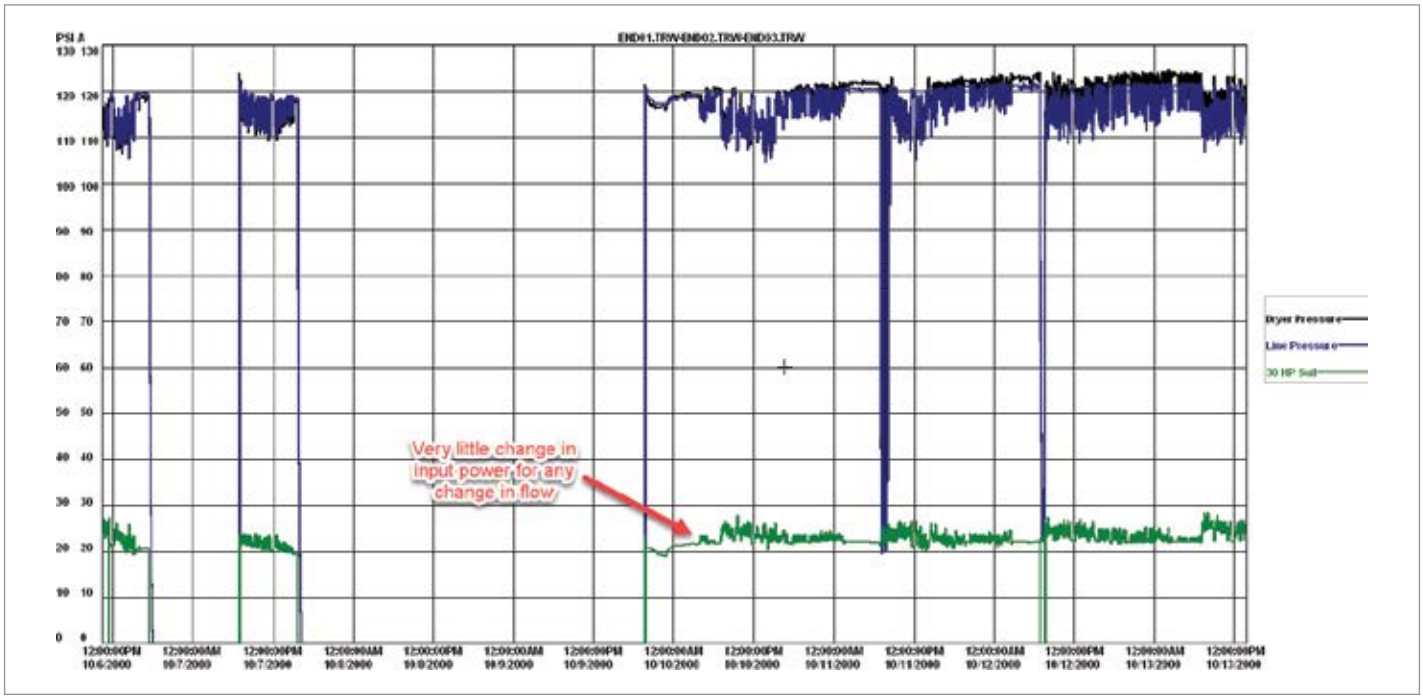


Figure 2: In modulation mode, the input amps change very little for any change in flow.

storage capacity of about 1,200 gallons total, about 10 gallons per cfm output of the compressor. This level of storage slows down the load unload cycles significantly, allowing less compressor blow downs per hour, reducing wasted power consumption.

Further to this, the new compressor controller had a built in algorithm allowing some start/stop operation during light loads. This reduces the compressor unloaded run time and lowers the overall power consumption. Operation in this mode requires a wide pressure band at the compressor discharge, about 20 to 30 psi, affecting the operation of compressed air powered processes if allowed to reach the plant. Therefore a pneumatically controlled pressure/flow control valve was recommended to limit the plant pressure to no higher than 98 psi. This device stabilizes the pressure and provides savings in artificial demand. Feeding unregulated compressed air demand pressures higher than necessary causes artificial demand. The auditor estimated these measures, along with leakage reduction, would reduce the compressed air system energy consumption by 50%.

Figure 3 shows the operation of the compressor with the large storage and pressure/flow control. The swing in discharge pressure was limited by the pressure rating of the compressor. The discharge pressure can be no higher than 125 psi, the maximum full load for the compressor, and no lower than about 100 psi, the minimum required plant pressure. The compressor operates in load/unload mode when conditions dictate starts per hour would exceed 4, but the control allows some shutdowns where possible. These immediate shutdowns limit the power wasted by running in the unloaded condition, consuming about 35% of air compressor full load power, even while producing no compressed air.

Verification

After the installation of the receiver and flow controller, data loggers were again placed on the system and it was determined the actual savings were 63% of previous operating costs, higher than expected. In addition to the changes due to the better control, the plant personnel had repaired leakage to a low level, and reduced the air compressor operating hours by turning off the air compressor when not needed during evenings and weekends. Installation of a cycling refrigerated air dryer also contributed to the savings. As a result Enduron received a

Proudly Presenting the 2017 Expert Webinar Series

BLOWER & VACUUM BEST PRACTICES
blowervacuumbestpractices.com

Integrating Aeration Blowers with Most-Open-Valve

Join **Keynote Speaker,** Tom Jenkins, President of JenTech Inc., to learn how Most-Open-Valve control is integrated with blower control to optimize aeration system energy requirements.

Tom Jenkins has over 30 years of experience with aeration blowers and blower controls.

Most-Open-Valve (MOV) control is a common modification of automatic DO control systems. By reducing the required blower discharge pressure, MOV can minimize power requirements if the MOV and blower controls are properly coordinated. This webinar will explain the basic principles of MOV control. Several techniques used to integrate aeration, MOV, and blower controls to optimize system performance and energy consumption will be explained.

Receive 1.0 PDH Credit.

Register for Free Today at
blowervacuumbestpractices.com/magazine/webinars

October 26, 2017 – 2:00 PM EST

METAL FABRICATOR KEEPS COMPRESSED AIR DEMAND LOW

significant financial incentive from Manitoba Hydro, making the overall project simple payback less than two years.

Ongoing Flow Maintenance

Since the early stages of the project, Richard Klassen had become aware of the high cost of compressed air, knowing a typical air tool consumes about seven to eight times the cost of a direct drive electric tool. He was also keen to keep his leakage levels low so he could minimize his compressed air costs and keep the size of his air compressor small. Many times production workers requested compressed air powered hand tools for particular processing functions, but after determining the energy costs the typical decision was to use electric tools in most areas of the plant, where possible. Plant maintenance personnel also took full advantage of their power utility's ultrasonic leak detector loaner program, borrowing the units for a focused leak detection blitz on a regular basis.

Through the years, the success of the company has required some building expansions and some significant production machine additions, however, rather than increasing the size of their air compressor, the company has actually found it possible to decrease the total air compressor horsepower size.

VSD Installation

The original lubricated screw air compressor was a low cost unit with a limited lifespan. After a number of years, Enduron started looking for a newer and more efficient version. Additional data logging showed despite the additional storage the load/unload air compressor control

A pressure differential of about 10 psi is maintained in the large storage tank in case of a high flow event exceeding the air compressor's capacity.

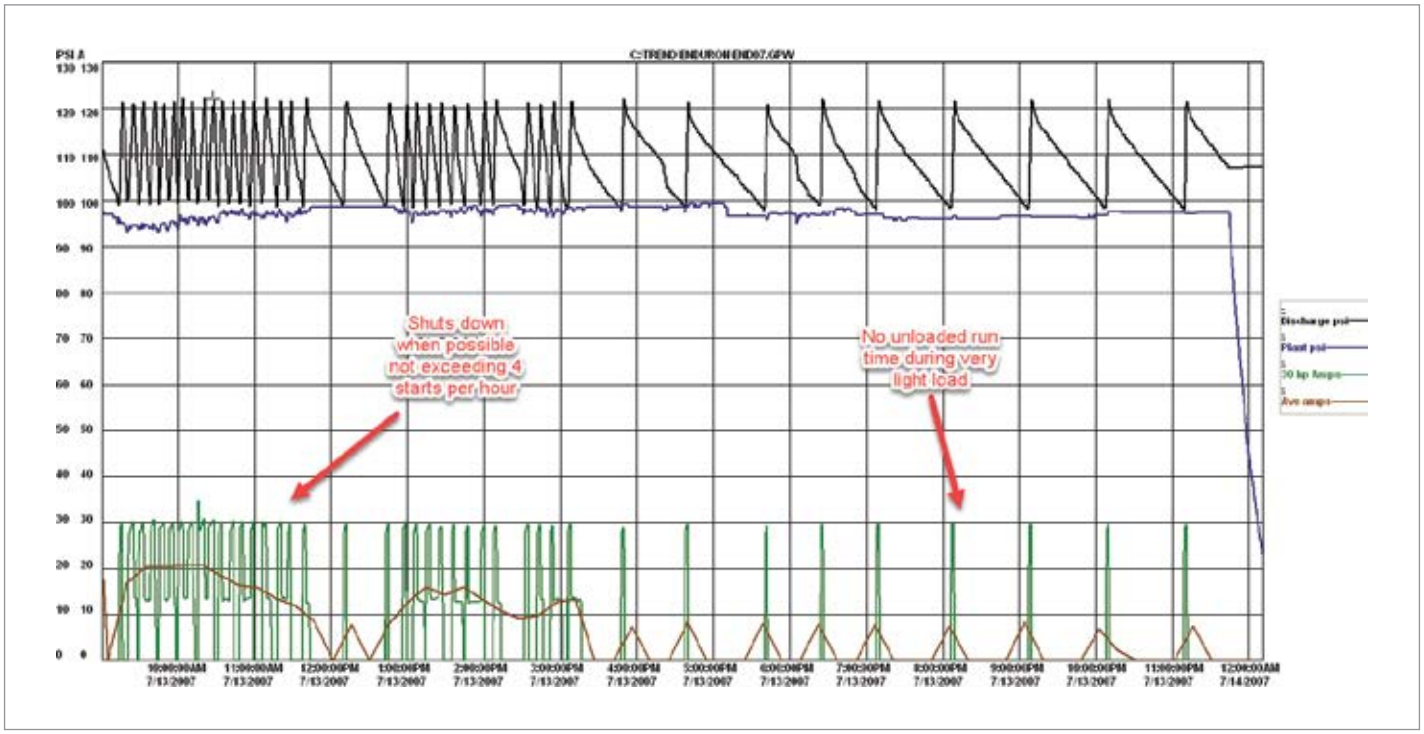


Figure 3: Adjustments to the settings and additional storage capacity allowed the air compressor to shut down between load cycles.

still allowed the air compressor to consume about 39% of its power in the unloaded state. In the old days not much could be done about this, but technology changes made it possible to improve significantly. Their air compressor supplier was offering a VSD version of their higher quality air compressor line.

This looked attractive to Enduron, especially when considering the power utility would support the change with additional incentive funding. A smaller 25 hp variable speed drive controlled air compressor was purchased for the main air compressor in the plant. The VSD unit varies the speed of the internal screw to match the flow output to the load, keeping the pressure constant, and at the same time eliminating any unloaded air compressor operation. The installation took place with no additional equipment upgrades required, as much had been done previously, and saved an additional 62% from the previous base case for a project payback of 1.7 years.

A variable speed drive air compressor did not need such large storage to run efficiently, but having a tank of such large size and the pressure/flow controller, was of good benefit to the operation of the Enduron system. The plant load profile has a few transient high flow events during peak production periods. In a typical system with small storage, these events would cause the need for a second air compressor to be operated, increasing peak electricity demand charges and consuming extra energy. But, since a pressure differential of about 10 psi is maintained in the large storage tank, if a high flow event exceeds the capacity of the air compressor the air can be supplied from storage without running any air compressor. Figure 4 shows how this happens with no low-pressure event experienced in the plant.

Flow Metering Benefits

As part of the verification of the second project a thermal mass flow meter was installed and funded by Manitoba Hydro to keep an eye on the total system flows. This meter was found to be an excellent tool to track compressed air usage and measure plant leakage, with leakage repair initiated whenever the flows during non-production hours increase to unacceptable levels. "Hydro recommended we install a flow meter on our air supply system and he helped us find a suitable one," said Richard Klassen, "We were surprised how much our system leaked.

The valved zones and an inexpensive ultrasonic detector he recommended help us track down the causes right away. Our leak rate dropped significantly and stayed low with constant attention. We were also surprised

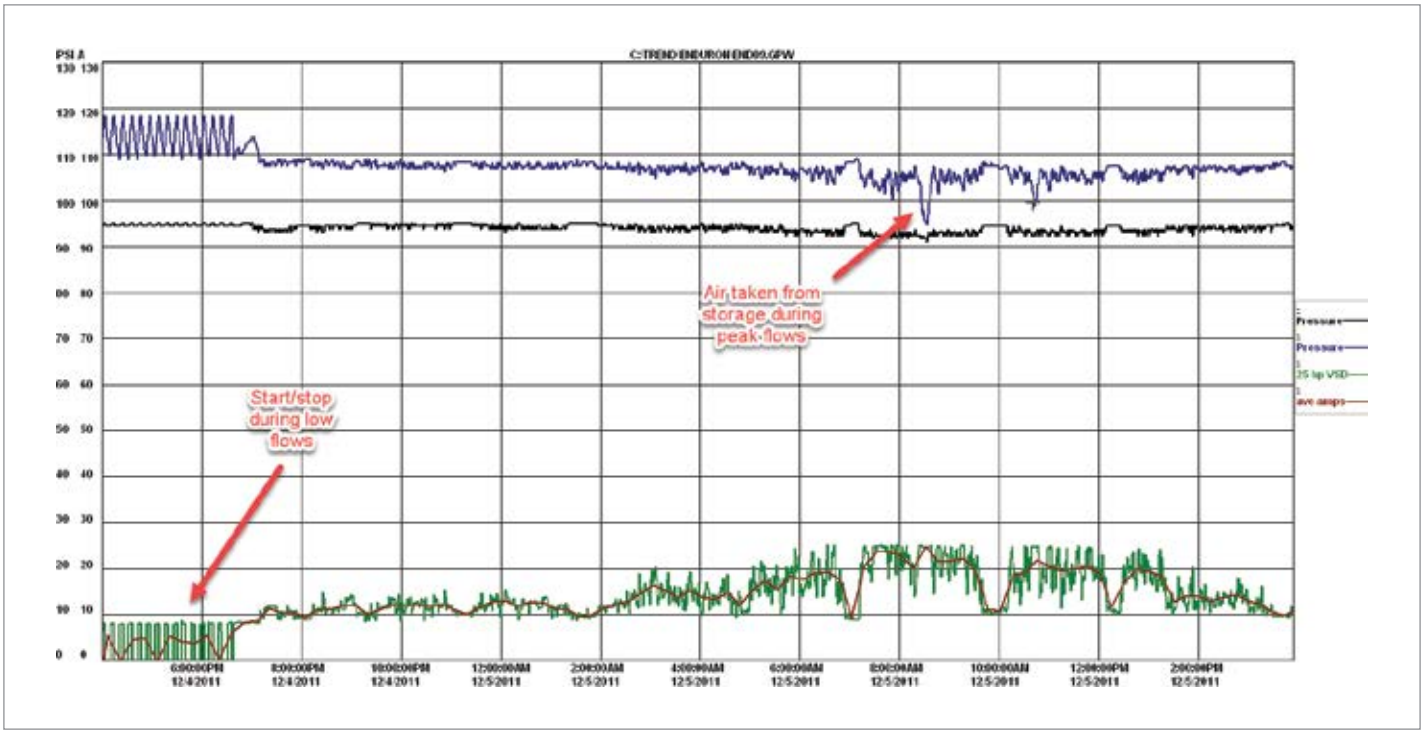


Figure 4: Use of larger storage allows the compressor to turn off between cycles at light loads, saving power

METAL FABRICATOR KEEPS COMPRESSED AIR DEMAND LOW

by how much air certain applications used. For example we used a compressed air bubbler to agitate a chromate pretreatment dip tank bath. When we realized how much air it used, we started to investigate a more energy-efficient agitation system, and along the way asked the chemical supplier for a recommendation. They said agitation was not required, and air bubbles actually shortened the life of the bath. Tests confirmed agitation was unnecessary. We turned off the bubbler and reduced our air consumption by 6%. That really adds up over time."

Enduron found another excellent use of these meters, in monitoring their nitrogen and other welding gas usage. "We decided to try flow meters on our Nitrogen system for the laser cutters. These are high-pressure, specially calibrated versions of the compressed air meter, so they were more expensive. As soon as we installed them, we found a stuck valve on one laser had been suspicious for about two weeks, and slow leak on the other had been there since the machine was installed." said Klassen. "The payback on the flow meters was less than two months. Our next step is to figure out how to monitor the flow meters remotely and send a message when the flow rate is outside of operating parameters. That will allow us to find problems much quicker in the future."

Ongoing Monitoring

From time to time the operation of the plant air compressors were monitored to ensure the efficiency of the system was maintained. Recently Richard Klassen was reviewing his plant electrical loads to determine if there was any addition potential to save energy. In measuring the operation of the VSD air compressor he noticed some higher than expected amp draws during non-productive loads. As a result, a compressed air auditor placed data loggers around the system. The data loggers showed there was a problem with the way the air compressor was adjusted. The unit had started to modulate at low flows, significantly affecting the efficiency of the air compressor. Adjustments are possible and the air compressor was returned to the previous condition. This is a good reminder of the value of regularly checking the operation of any system.

Conclusions

Based on these findings we can form the following conclusions:

- Conversion from reciprocating to screw air compressors can cause a significant increase in compressed air consumption.
- The use of modulation control is inefficient.
- Addition of large storage and operation in load/unload mode can save significant operating costs.
- Use of VSD control can save even more.
- VSD air compressors can benefit from the installation of large storage and pressure/flow control, where peak flows exceed the capacity of the air compressor.
- A focus on load reduction and leakage repair can reduce the size of the required compressor and keep compressed air operating costs low.
- Flow meters are very useful tools for tracking compressed air and other gasses.
- Ongoing compressed air monitoring can detect problems with the system requiring intervention. BP

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

For more ***Metal Industry*** articles visit
www.airbestpractices.com/industries/metals

"The payback on the flow meters was less than two months. Our next step is to figure out how to monitor the flow meters remotely and send a message when the flow rate is outside of operating parameters. That will allow us to find problems much quicker in the futurer."

— Richard Klassen, President, Enduron

processing

PROSPEROUS INNOVATIONS.

PROCESS EXPO is the nation's largest food and beverage processing show. Professionals from a cross section of vertical markets, including bakery, cereal, grain, beverage, dairy, meat, poultry, seafood, prepared foods, fruits and vegetables, confectionery and pet foods, explore new technology in equipment and food processing and packaging products.

PROGRESSIVE IDEAS.

Network with 15,000 colleagues to discover new ways to maximize profits and expand your lines. Attend education sessions on the latest trends and regulations in food safety and hygienic design led by the Food Safety Summit experts.

PROVEN RESULTS.

Held in the convenient location of Chicago, and during the fall when budgets are being prepared for capital expenses, PROCESS EXPO is a proven show where you can touch equipment and see demonstrations right on the show floor from hundreds of knowledgeable suppliers.

Visit myprocessexpo.com/compressedair for more information.

Use this code when registering: CA17

PROCESS EXPO

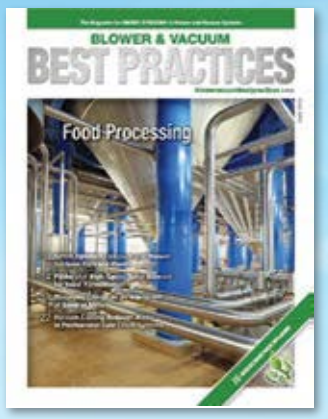
September 19–22
Chicago, IL USA

2017

FREE SUBSCRIPTION

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

You'll get **FOUR ISSUES** of each supplement this year!



EVERY ISSUE CONTAINS BEST PRACTICES FOR

Industrial Vacuum • Vacuum Generation • Industrial & Aeration Blowers • Blow-Off Air

Subscribe at **blowervacuumbestpractices.com**

Subscribe Now!

EVERY ISSUE CONTAINS BEST PRACTICES FOR

Cooling Towers • Central Plant Chillers • Cooling System Components

Subscribe at **coolingbestpractices.com**

Subscribe Now!

RESOURCES FOR ENERGY ENGINEERS

TECHNOLOGY PICKS

Kaeser Launches Redesigned FSD Series Rotary Screw Air Compressors

Kaeser Compressors has redesigned the FSD series of rotary screw air compressors to deliver an energy efficiency advantage of up to 26% over the competition. With flows from 1243 to 2052 cfm and pressures up to 217 psig, the new FSD 350 and 450 offer lower life cycle costs thanks to their simple maintenance and reduced energy costs.

Series features include IE4 super premium efficiency drive motors, an enhanced cooling design, eco-friendly filter element, integral moisture separator with drain, and an Electronic Thermal Management system. Units also come standard with Sigma Control 2™. This intelligent controller offers unsurpassed air compressor control and monitoring with enhanced communications capabilities for seamless integration into plant control/monitoring systems and the Industrial Internet of Things (IIoT).

Built-in heat recovery options provide sustainable energy savings and contribute to lowering a plant's carbon footprint.

The newly redesigned FSD Series from Kaeser offers flows from 1243 to 2052 cfm and pressures to 217 psig.

For more information, visit www.kaesernews.com/FSD. For more information or to be connected with your local authorized Kaeser representative, please call (877) 596-7138.

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.

BOGE Announces New Refrigerated and Tandem Dryers

With the announcement of the new DS-2 and FRDA dryers, BOGE Kompressoren aims to set new standards in the process of removing water vapor from compressed air. The DS-2 refrigeration dryer works with energy savings of up to 30%, with higher flow capacity compared to prevailing market systems. For highly sensitive applications with pressure dew points between –70°C and +3°C BOGE now offers a tandem dryer for the first time. The FRDA (fridge desiccant adsorption dryer) combines the advantages of refrigeration and adsorption dryers. The pressure dew points can be selected flexibly. The FRDA can also be positioned in a small space due to the compact design of the machine.

Compressed air dryers are essential for avoiding interruptions to operations or even production downtime due to water in the compressed air system and in the final application. For the majority of applications, the drying capacity of a refrigeration dryer with residual moisture content of up to 6 g/m³ is entirely adequate. The new DS-2 refrigeration dryer from BOGE also fulfils this requirement. The decisive competitive difference is in the efficient use of resources required of such systems. With the new fully integrated aluminum heat exchanger, power losses in the refrigeration cycle and the use of coolants are lowered. Combined with a reduction of power consumption of up to 30%, the overall operating costs of the BOGE DS-2 are extremely low. For optimum operation, the whole series has digital control including an isolated alarm contact. This gives an immediate alert if operating conditions such as the pressure dew points move into the critical range. Models from 2.6 m³/min. are available with an optional energy-saving function. This reduces the

RESOURCES FOR ENERGY ENGINEERS

TECHNOLOGY PICKS

The new BOGE FRDA tandem dryer is a combined refrigeration and adsorption dryer.

power consumption in partial load operation even further. Designed for 50 and 60 Hz, the new DS-2 refrigeration dryers are suitable for use worldwide.

For the Highest Hygiene Requirements

With the FRDA tandem dryer, BOGE includes a combined refrigeration and adsorption dryer in its product portfolio for the first time. The new technology completes the existing range of adsorption dryers. The FRDA is the optimum solution when consistent but variable pressure dew points between –70°C and +3°C are required. The combination of the two proven drying processes enables a high level of energy efficiency and flexibility. It is simple to switch between the pressure dew points of a refrigeration dryer and those of an adsorption dryer without hardware adjustments being required, by means of the tandem dryer control. The result is residual moisture of up to 0.003 g/m3, irrespective of seasonal temperature fluctuations. The FRDA tandem dryer is also distinguishable by its compact machine design. The technology is therefore suitable for container installations and where little space is available. In comparison with conventional adsorption dryers, not much maintenance is required. All in all, users of FRDA benefit from low overall running costs.

The new BOGE DS-2 Series refrigerated dryer features an integrated aluminum heat exchanger.

About BOGE Air Compressors

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

Edgetech Instruments Sentry Easy to Install with Compressed Air Module

The new Edgetech Instruments SENTRY is designed specifically as a compressed air monitor and alarm system. It senses both the dew/frost point and pressure in industrial compressed air systems. It also activates two alarm functions giving visible and audible indications if the compressed air dew/frost point increases or pressure decreases beyond user configurable set points.

Using a Smart Multi-Sense Probe to continuously monitor both parameters, the probe is inserted into the pressurized compressed air stream giving immediate warning of a system leak or failure of an air dryer or compressor. The Sentry's highly visible strobe light and highly audible pulsing alarm activate if the air system goes out of predetermined ranges.

TECHNOLOGY PICKS

The SENTRY is easy to install using the available Compressed Air Module (CAM). The CAM is comprised of an industrial ball valve, probe sample chamber and outlet valve at the compressed air sample point. Closing the ball valve isolates the probe sample chamber from high-pressure air for service or inspection. The CAM provides a ¾ inch NPT female fitting for simple and safe connection to the compressed air system. Using the CAM, measurements can be made either at full line or atmospheric pressure by adjusting the CAM's inlet and outlet valves. There is no need to depressurize the compressed air system for sensor maintenance.

The SENTRY is easy to install using the available Compressed Air Module (CAM).

The SENTRY with CAM is a turnkey alarm system, ideal for industrial compressed air monitoring and control, alerting personnel to upset air quality or pressure conditions quickly and reliably. It can be used to monitor utility source air for overall management as well as point of use air to protect sensitive processes or equipment.

About Edgetech

Edgetech Instruments designs and manufacturers accurate and reliable absolute humidity hygrometers, relative humidity transmitters, humidity probes, dew/frost point analyzers, relative humidity calibrators, dew/frost point generators and oxygen measurement instrumentation. Edgetech products are designed, manufactured and calibrated to the highest industry standards in a modern ISO 9001:2008 registered, ISO/IEC 17025:2005 accredited facility located in Hudson, Massachusetts. All calibrations are traceable to NIST.

For more information contact Edgetech Instruments Inc., Email: h2o@edgetechinstruments.com or visit www.edgetechinstruments.com

Kahn Releases New Easidew PRO I.S. Dewpoint Transmitter

Kahn Instruments, Wethersfield, CT, a leading manufacturer of advanced moisture-measurement instrumentation, announced the new Easidew PRO I.S. Dewpoint Transmitter. The Easidew PRO I.S. is a ruggedized version of the intrinsically safe Easidew I.S. Transmitter and is designed for continuous measurement of moisture content of gases in hazardous area applications typically found in natural gas, petrochemical and process industries. Key features include:

- Heavy duty, process type NEMA 4 / IP66, weatherproof stainless steel housing with ½" NPT conduit entry fitting.
- FM/CSA certified for Class I, Div. 1, Groups A, B, C, & D T4 hazardous location use
- 2-wire, loop-powered, 4-20 mA linear, analog output
- Output configurable in °F or °C dewpoint or PPMv moisture content (0-100, 0-1000 and 0-3000 PPMv ranges)
- Operating pressure up to 5000 PSIG

The Easidew PRO I.S. Transmitter has a dewpoint measurement range of -148°F to +68°F, accuracy of ±3.6°F and operates from any 12 to 28 VDC power source. The instrument also features field adjustable, resettable failure modes for Over Range, Under Range and Sensor Fault conditions, and temperature compensation.

The Easidew PRO I.S. Transmitter is economical to purchase, install and maintain. Installation costs are minimal, because of the transmitter's ruggedness, small footprint and simplicity. Ongoing operating costs are low, because the Easidew PRO I.S. is reliable and durable. Only periodic re-certification is required to maintain calibration accuracy. Kahn even offers an exchange program, so a customer's process is never out of operation.

The Easidew PRO I.S. Transmitter has a dewpoint measurement range of -148 °F to +68 °F.

For more information contact Kahn Instruments, Inc., email: hygros@kahn.com or visit www.kahn.com.

RESOURCES FOR ENERGY ENGINEERS

TECHNOLOGY PICKS

CS-Instruments Announces New Compressed Air Quality Test Station

CS-Instruments GmbH, with a North American Office in Grand Rapids, Michigan, is a leading German manufacturer of high precision compressed air sensors and monitoring solutions. The company has announced the arrival of the Compressed Air Quality Test Station in both mobile and stationary versions to check compressed air quality based on ISO 8573.1-2010.

Features include:

- Oil Check - residual oil content measurement. The test station continuously measures the vaporous residual oil content in the compressed air system and detects exceeding oil content immediately.
- Particle counter - PC 400 - The optical particle counter measures particles from size of 0.1 µm and is suitable to continuously measure ISO 8573.1-2010 Class 1
- Moisture FA Series Dew Point sensor. FA series sensors measure the dew point in a compressed air system down to -80°C [-112°F]
- Pressure measurement in PSIG
- DS400 [up to 4 channel] or DS500 [up to 12 channel] monitoring solution communication via USB, Ethernet or RS485 [ModBus]
- CS-Soft-Basic for evaluation with graphs and tables

For more information contact CS Instruments at email: sales@cs-instruments.us, tel: 616-828-1024 or visit www.cs-instruments.us

The new ISO 8573.1-2010 Compressed Air Quality Test Station contains a particle counter with the ability to measure particles as small as 0.1 µm.

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

COMPRESSED AIR BEST PRACTICES®
www.airbestpractices.com

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.

Compressed Air Best Practices® is a trademark of Smith Onandia Communications, LLC. Publisher cannot be held liable for non-delivery due to circumstances beyond its control. No refunds. SUBSCRIPTIONS: Qualified reader subscriptions are accepted from compressed air professionals, plant managers, plant engineers, service and maintenance managers, operations managers, auditors, and energy engineers in manufacturing plants and engineering/consulting firms in the U.S. Contact Patricia Smith for subscription information at tel: 412-980-9902 or email: patricia@airbestpractices.com. REPRINTS: Reprints are available on a custom basis, contact Patricia Smith for a price quotation at Tel: 412-980-9902 or email: patricia@airbestpractices.com. All rights are reserved. The contents of this publication may not be reproduced in whole or in part without consent of Smith Onandia Communications LLC. Smith Onandia Communications LLC. does not assume and hereby disclaims any liability to any person for any loss or damage caused by errors or omissions in the material contained herein, regardless of whether such errors result from negligence, accident, or any other cause whatsoever. Printed in the U.S.A.

ENVIRO/TECH INK
EnviroTech is a registered trademark.

SFI
Certified Chain of Custody
Promoting Sustainable Forestry
www.sfiprogram.org
SFI-00993

COMPRESSED AIR

BEST PRACTICES

airbestpractices.com

FREE SUBSCRIPTION

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

2017 FOCUS INDUSTRIES!

Poultry & Meat Packaging • Plastic Processing & Blow Molding • Pharmaceutical & Laboratory Air • Chemical Plants & Refineries • Energy-Efficiency System Assessments
Food Processing & Conveying • Compressed Air Measurement • Wastewater Aeration • Metal Fabrication & Machining • Food & Beverage Snack Foods • IoT & Industry 4.0

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

Subscribe Now!

To subscribe visit **airbestpractices.com**

THE MARKETPLACE

COMPRESSED AIR BEST PRACTICES
airbestpractices.com

ADVERTISER INDEX

Company	Page	Web Site
Kaeser Compressors	Outside Back Cover	www.us.kaeser.com/cabp
Atlas Copco	Inside Front Cover	www.atlascopco.us
DV Systems	Inside Back Cover	www.dvcompressors.com
CoAire Compressors	5	www.coaire.com
Relevant Solutions	6	www.relevantsolutions.com
BEKO Technologies	7	www.bekousa.com
nano-purification solutions	8	www.n-psi.com
JORC Industrial	9	www.jorc.com
CDI Meters	10	www.cdimeters.com
Sullair Compressors	11	www.sullair.com
VP Instruments	12	www.vpinstruments.com
Sullivan-Palatek	13	www.sullivan-palatek.com
Mikropor	15	www.mikroporamerica.com
Howden	16	www.howden.com
Summit Lubricants	17	www.klsummit.com
Hertz Kompressoren USA	19	www.hertz-kompressoren.com
Kobelco	21	www.knw-series.com
Boge Compressors	23	www.boge.com/us
Anest Iwata	25	www.anestiwata.com
Pure-Aire	27	www.pure-aire.com
World Energy Engineering Congress	28	www.energycongress.com
ENMET	35	www.enmet.com
Process Expo	41	www.myprocessexpo/compressedair

JOBS

SERVICE TECHNICIANS

Kaeser Compressors is seeking hardworking, dedicated individuals with solid field experience performing installations, PM, and repair of industrial equipment. Candidates should have excellent communication and problem solving skills, ability to be self-directed, a clean driving record and be PC literate. Positions are available in Texas, Kentucky, Illinois, Kansas, Ohio, Colorado, California, Wisconsin, and Virginia.

Discover more about Kaeser and our open positions at www.us.kaeser.com/careers.

KAESER COMPRESSORS

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

COMPRESSED AIR BEST PRACTICES
Subscribe at airbestpractices.com

TECHNOLOGY & JOBS

AMERILUBE®
Advanced Technology Lubricants
SINCE 1983
Compressor Lubricant Specialists
Distributors Wanted • Private Label Program
New 2017 Catalog Available
Email or call for your copy
American Synthol Inc.
jeff@americansynthol.com
www.americansynthol.com
888-239-3946

STERLING
ENERGY SERVICES, LLC
COMPRESSED AIR METERING SOLUTIONS
AUTOMATED DATA COLLECTION & REPORTING
COMPRESSED AIR SYSTEM AUDITS
FACILITY ENERGY ASSESSMENTS
www.sterling.energy
404.445.2272 | info@sterling.energy

TRACE Analytics LLC
COMPRESSED AIR QUALITY TESTING
QUALITY
EFFICIENCY
&
SAFETY
1-800-247-1024 x4
AIRCHECKLAB.com

Job & Product Marketplace Advertising Information

Reach 13,000+ readers of Compressed Air Best Practices® Magazine with Marketplace Ads every month!

Prices are $300.00 per Job Marketplace Ad and $350.00 per Product Marketplace Ad ($300 if 6 or more ads are placed).

Contact Rod Smith at rod@airbestpractices.com to schedule your Marketplace Ads.

LA-MAN
We Make Compressed Air Work®
Solve your compressed air problems
• Point of use filter.
• CFM sizes of 15,50,80,150, and larger.
• Protect and extend the life of pneumatic equipment
DIRTY, WET AIR
CLEAN, DRY AIR
You want clean, dry compressed air. Our patented Extractor/Dryer will provide you clean, dry compressed air.
For More Info:
1-800-348-2463
www.laman.com

Save Energy From Thin Air!
I'M AN ENERGY SAVING SOLUTION
INTELLIGENT
FLOW CONTROL
• Reduces Artificial Air Demand
• Saves energy consumed by Air Compressors
• Maintains stable air pressure within ±1 psig
• Works with all types of compressors
• Downstream & Upstream Pressure Control
• Colour Graphic HMI touch screen
• Real Time & Historical Trends
• Remote PC Monitoring & Control
Godrej & Boyce Mfg.Co.Ltd
Tel.: +91-22-67962251 to 2255 E-mail: casene@godrej.com;
www.godrej-airsolutions.com
SEEKING DISTRIBUTORS

THE MARKETPLACE

TECHNOLOGY

High Efficiency Compressor Controllers

Control Rotary Screw, Vane, Scroll or Recip Compressors

Save Energy controlling up to FOUR compressors and qualify for **Utility Rebates**.

- Automatic Lead/Lag Control-up to FOUR Compressors
- Accurate Pressure Control with Pressure Transducers
- Compressors and Vacuum Pumps from 1 to 250 hp

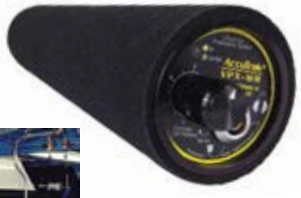
Thousands of Installations Worldwide. Call for Application Engineering.

Standard Pneumatic Products, Inc.
Tel: 203-270-1400 • **Toll free:** 800-979-9156
Email: sales@stdpneumatics.com
www.stdpneumatics.com

Superior®
AccuTrak®
Ultrasonic Inspection Systems

The Ultimate Air & Gas Leak Detector

MADE IN USA



AccuTrak® VPX-WR

Find Compressed Air Leaks Fast!
• Also any Gas, Refrigerant or Vacuum.
• Rugged Design for Harsh Environments
• Sealed to Resist Water, Oil, Dust & Chemicals
• Professional's Choice for Air Leak Surveys

SuperiorSignal.com/CA

COMPRESSED AIR
SENTRY
SYSTEM ALARM

NEW

Private Label Options Available

- **Detects Pressure Loss & Dryer Failure**
- **Remote DewPoint and Pressure Sensor**
- **Strobe Lamp and Horn Alarm**
- **4-20mA Outputs/Relay Contacts**

Edgetech Instruments
TEL: (508) 263-5900
Richard.Nyce@Edgetechinstruments.com
www.Edgetechinstruments.com

INTRODUCING 7.5 HP COMPACT ROTARY SCREW

Call for more information: (770) 529-4731

SCHULZAMERICA.COM
SCHULZ OF AMERICA, INC.

Who is the world biggest air end manufacturer?

HANBELL PRECISE MACHINERY CO., LTD.
youngsupyoo@gmail.com
www.hanbell.com.cn +86-156-1872-6825

Portable dew point meter

DP 510
with external sensor input

CS INSTRUMENTS
www.cs-instruments.us
info@cs-instruments.us
Phone: 616 828 1024

IT'S NOT ONLY THE PRODUCTS, BUT PEOPLE AT DV SYSTEMS THAT MAKE THE DIFFERENCE FOR MY BUSINESS.

DENNIS BERMANI, OAK STREET CLASSICS, MOORESVILLE, NC

AIR COMPRESSORS 5 TO 200 HP

JOIN US, BECOME A DISTRIBUTOR

With over 125 years of manufacturing excellence it's not only our products that are built to last, we strive to build lasting relationships. Contact us to learn more.

dvcompressors.com **1-877-687-1982**

DV Systems Ltd. 128-B Talbert Rd., Mooresville, NC 28117

BUILT BETTER

CUSTOMER
Success Story

KAESER COMPRESSORS
Built for a lifetime.™

Sweet Savings!

A compressed air audit opens a world of savings opportunities

PROBLEM: One of the world's leading candy and gum manufacturers had no idea how much their compressed air system was costing them. Four compressors (totaling 290 hp) supplied the air needed for pneumatic controls, packaging, and wax line extrusion applications. Excessive water in the compressed air lines, steep maintenance costs, and high noise levels had them looking for a new solution.

SOLUTION: A comprehensive Air Demand Analysis (ADA) established a demand profile for the plant and showed how they were using compressed air throughout the week. It also identified areas of waste and inefficiency. By installing a 100 hp variable frequency drive compressor and two 75 hp fixed speed compressors, they would have all the air needed—with one of the fixed speeds acting as a back-up. This split system solution would bring energy—and noise levels—well under control. A Sigma Air Manager 4.0 master controller could provide on demand energy reports so they would always know how their system was performing and what it was costing.

RESULT: In just over 9.5 months, the project has paid for itself. Annual energy costs have been cut by more than 800,000 kWh. Part of these savings came from reducing the plant pressure from 125 psi to 100 psi. Additionally, the new energy efficient dryers installed have taken care of the moisture concerns. Needless to say, these savings couldn't get any sweeter.

Specific Power of Previous System:	47.16 kW/100 cfm
Specific Power of New System:	17.77 kW/100 cfm
Annual Energy Cost of Previous System:	$128,756
TOTAL ANNUAL ENERGY SAVINGS:	**$80,235**
Utility Incentive:	**$80,200**

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

Kaeser Compressors, Inc. • 866-516-6888 • us.kaeser.com/CABP
Built for a lifetime is a trademark of Kaeser Compressors, Inc. ©2017 Kaeser Compressors, Inc.
customer.us@kaeser.com