Bonneville Power Incentives | Roxane Laboratories Assessment | Fixing Leaks

May/June 2010

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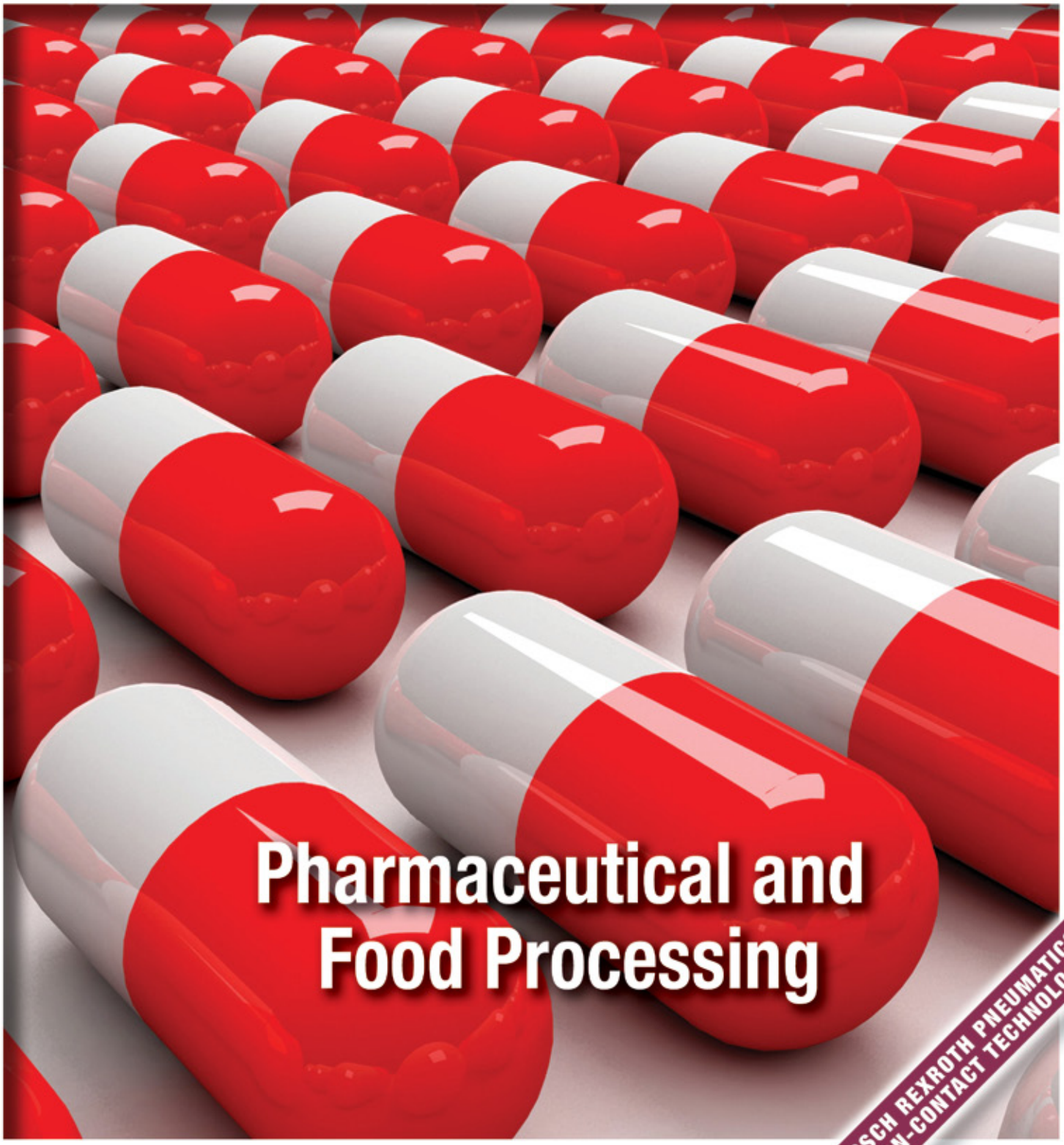

Pharmaceutical and Food Processing

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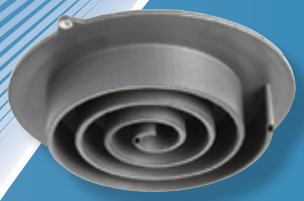

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HITACHI
Inspire the Next

SUSTAINABLE MANUFACTURING FEATURES

COLUMNS

FROM THE EDITOR

Food and Pharmaceutical Processing

PepsiCo and Merck were both named 2010 ENERGY STAR Partner of the Year by the U.S. Environmental Protection Agency

Food and pharmaceutical processing industries are important industries in the United States. In this edition, we are able to see how compressed air systems were optimized in different ways.

Roxane Laboratories, a division of Boehringer Ingelheim, faced a great problem: How to properly configure the compressed air system for a planned plant expansion?! Hank Van Ormer of Air Power USA shares with us the results of their System Assessment, which not only made the expansion possible, but saved Roxane $61,000 per year in energy costs.

The Bonneville Power Authority has introduced the Energy Smart Industrial Program to over 88 participating utilities in the Northwest. Designed and administered by Cascade Energy Engineering, the Energy Smart Industrial Program takes into account all opportunities and obstacles to implementing energy efficiency projects. Please be sure to read about some of the very innovative energy incentives introduced by this program.

When we think of ultrasound leak detectors, we normally think of compressed air leak audits. Alan Bandes of UE Systems makes us aware of how low-level leaks in heat exchangers can be detected through the use of ultrasonic probes. A supplier of heat exchangers to food processors explains how they were able to improve their quality by regularly checking for minute, low-level leaks by using ultrasound technology.

Ron Marshall of the Compressed Air Challenge® provides us with another insightful article on how to "Find and Fix Leaks" in compressed air systems. Bosch Rexroth also shares with us how pneumatics were able to reduce cycle times for a dental hygiene product manufacturer. They have introduced a new Non-Contact Technology, enabling packaging processes to be automated and production cycles to be shortened.

We hope you enjoy this edition, and thank you for your support and for investing in Industrial Energy Savings. BP

ROD SMITH
Editor
rod@airbestpractices.com

SUSTAINABLE MANUFACTURING NEWS

J.R. Simplot, ConAgra, Merck, Heinz, Del Monte, PepsiCo

SOURCED FROM THE WEB

Three Potato Processing Plants First to Earn EPA ENERGY STAR

The U.S. Environmental Protection Agency (EPA) is recognizing the first three frozen fried potato processing plants to earn the Energy Star for superior energy performance. The three potato processing plants to first earn EPA's Energy Star are J.R. Simplot Company's Aberdeen, Idaho plant; J.R. Simplot Company's Othello, Wash. plant; and ConAgra Foods Lamb Weston Inc.'s Quincy, Wash. plant.

These plants perform in the top 25% for energy efficiency nationwide and, on average, use nearly 20% less energy when compared to similar plants across the country. Together, these plants annually save more than $10 million and prevent nearly 40,000 metric tons of carbon dioxide equivalent, which is equal to the emissions from the yearly electricity use of 5,000 homes. These businesses are increasing their energy efficiency, saving money while reducing the amount of pollution emitted into our environment.

The food processing industry is an essential domestic industry that provides more than one million jobs annually. Announced in October 2009, EPA's Energy Star Energy Performance Indicators for food processing have become important tools in helping improve the energy efficiency of the industry, which spends nearly $7 billion on energy each year. Energy Star Energy Performance Indicators allow companies to measure their energy performance against others in the industry, while achieving breakthrough improvements in energy efficiency.

Source: www.energystar.gov

ENERGY STAR Food Processing Focus Participating Companies:

Campbell Soup
Cargil
ConAgra
Del Monte
General Mills
Heinz
Kellogg
Kraft
Nestle
Ocean Spray
PepsiCo
Simplot

EPA and DOE Announce Changes to the ENERGY STAR® Program

The U.S. Environmental Protection Agency and the Department of Energy today jointly announced changes to the Energy Star product certification process to ensure that only products meeting the program requirements can receive an Energy Star label. These changes accelerate steps DOE and EPA have initiated over the past several months to bolster the verification, testing and enforcement aspects of the Energy Star program.

"The Energy Star program started out small and has grown quickly, and now the brand is immensely valuable to consumers and businesses," said Gina McCarthy, EPA Assistant Administrator for Air and Radiation. "The safeguards we're putting into effect are essential for the millions of consumers who rely on Energy Star products to help save energy, money and the environment."

"Consumers trust the Energy Star brand to save them money and reduce carbon pollution," said Cathy Zoi, DOE Assistant Secretary for Energy Efficiency and Renewable Energy. "The steps we are taking to strengthen the program will ensure that Energy Star continues to be the hallmark for energy efficiency in the years to come."

Effective immediately, manufacturers wishing to qualify their products as Energy Star must submit complete lab reports and results for review and approval by EPA prior to labeling. Following a thorough review of the Energy Star qualification approval process, EPA has strengthened its approval systems and is no longer relying on an automated approval process. All new qualification applications will be reviewed and approved individually by EPA.

Additionally, companies applying to be program partners will not be able to access the Energy Star certification mark until EPA has approved a specific Energy Star-qualified product submitted by the company. EPA and DOE are further strengthening the certification process with a requirement effective at the end of the year that all manufacturers must submit test results from an approved, accredited lab for any product seeking the Energy Star label. Testing in an accredited lab is currently required for certain product categories, including windows, doors, skylights and compact fluorescent lighting. The new process will extend the requirement to each of the more than 60 eligible product categories under the Energy Star program.

These efforts are in addition to enforcement and testing procedures already in place to ensure compliance with Energy Star specifications. The Department of Energy is conducting off-the-shelf product testing for some of the most common household appliances and a recent Inspector General audit found that 98% of products tested fully complied with Energy Star requirements. The EPA and DOE are committed to continually strengthening and improving the Energy Star program, which provides information to consumers to help identify the most energy efficient products on the market that will save them money and reduce carbon pollution.

Source: www.energystar.gov

SUSTAINABLE MANUFACTURING NEWS

J.R. Simplot, ConAgra, Merck, Heinz, Del Monte, PepsiCo

Merck Receives 2010 ENERGY STAR® Sustained Excellence Award

Merck & Co., Inc. announced that it has received a 2010 ENERGY STAR® Sustained Excellence Award from the U.S. Environmental Protection Agency (EPA) for its continued efforts to protect the environment through energy efficiency.

The EPA has recognized Merck, an ENERGY STAR partner since 2004, for five consecutive years — twice as Partner of the Year and now for the third time for Sustained Excellence. In November 2009, Merck completed its merger with Schering-Plough Corporation. Schering-Plough was also an ENERGY STAR Partner and earned the 2009 ENERGY STAR Partner of the Year award.

The 2010 ENERGY STAR Sustained Excellence Award recognizes the accomplishments of the energy efficiency programs at Merck and Schering-Plough, and the integration of these award-winning programs into a single program that preserves and builds upon the best practices of both. "Managing energy use is consistent with Merck's values as a health care company and is critical to our business operations," said Rodney Freeman, Vice President, Global Facilities Management, Merck & Co., Inc. "Our partnership with ENERGY STAR is part of our commitment to reduce the Company's environmental footprint — including energy use improvements, reduced water use and converting to renewable resources such as solar power."

"The EPA is recognizing Merck with our highest ENERGY STAR award — the 2010 Sustained Excellence Award," said Gina McCarthy, EPA Assistant Administrator for Air and Radiation. "Merck's continued leadership and commitment to energy efficiency is a testament to what we can accomplish to reduce greenhouse gas emissions and protect our global environment."

Merck's world headquarters in Whitehouse Station, N.J. qualified for the ENERGY STAR label in 2007 and 2008. The legacy Schering-Plough facility in Cleveland, Tennessee earned an ENERGY STAR award in 2009 for ranking in the top 25% of pharmaceutical-plant energy performance nationwide. The plant used nearly 35% less energy than similar pharmaceutical plants across the country. Key 2009 accomplishments included:

- Achieving an improvement in energy intensity equivalent to eliminating 4,500 vehicles for one year or powering 3,000 American homes
- Integrating two award-winning energy programs into a single management system, preserving and building on the best practices of each former program, such as rolling out an energy project-tracking database to all new Merck sites
- Earning the ENERGY STAR for its Cleveland, TN plant, one of the first four pharmaceutical manufacturing plants in the United States
- Focusing energy assessments on laboratory ventilation, motor efficiency, steam traps and wraps, alternative energy and continued retro-commissioning studies
- Promoting ENERGY STAR and energy management in public forums, including pharmaceutical trade and corporate climate meetings
- Improving vehicle fuel efficiency in the global fleet by piloting hybrids and implementing improved fuel efficiency standards

Source: www.merck.com, www.energystar.gov

Heinz GHG Emission Reduction Goals

Heinz publishes goal to reduce GHG emissions 20% by 2015 by focusing on eight key areas:

Energy Consumption — 20% reduction through improved operational efficiency

Packaging — 15% reduction by the introduction of alternative packaging materials and reduction of existing packaging use

Transportation — 10% reduction through improved efficiency of distribution network

Renewable Energy — 15% to come from renewable sources, including solar, biomass and biogas

Agriculture — 15% reduction of carbon footprint, 15% reduction of water usage, improvement of yields by 5% through use of hybrid tomato seeds that require less water, fertilizer, pesticides and fuel to harvest

Water — 20% reduction through reuse and improved sanitation techniques

Solid Waste — 20% reduction through increased recycling and reuse of waste

Employees — Increase employee engagement through a voluntary personal sustainability campaign

Source: www.heinz.com

SUSTAINABLE MANUFACTURING NEWS

J.R. Simplot, ConAgra, Merck, Heinz, Del Monte, PepsiCo

Del Monte Foods Announces Goals

To effectively monitor our key environmental performance indicators, we established a baseline year of 2007 with a target year of 2016 in each of our priority focus areas. These focus areas are Agriculture, Processing, Packaging and Distribution. The goals for the Processing focus area are:

- 10% reduction in greenhouse gas emissions per ton of finished product
- 20% reduction in fresh water usage per ton of finished product
- 20% reduction in solid waste going to landfill from Del Monte operations per ton of finished product

Del Monte Foods owns 20 production facilities that process fruits, vegetables and other ingredients to make our consumer products and pet food.

Most of the facilities are located in the United States. However, we also own two facilities in Mexico and one in Venezuela. At each site, we are beginning to track and manage our performance with regard to materials, energy, water, waste and emissions. We have adopted Lean manufacturing standards to streamline production processes and eliminate waste and inefficiency. Through these efforts, we are improving yields, reducing costs and eliminating risk.

It may seem like a simple thing, but another way that we minimize our facilities' footprint is by ensuring that our processing plants are as close as possible to the fields where our crops are grown and harvested. Although the obvious benefit is the reduction in fuel used for transporting the produce (and reductions in related air emissions), co-locating our facilities means that we are using the freshest possible fruits and vegetables to make our products. We are also reducing the amount of produce that goes to waste because of spoilage or transportation-related damage. In sum, it's another win-win: better tasting products made from fresher crops coupled with reduced costs related to transportation and spoilage.

Energy Consumption

Similar to other manufacturing plants, our facilities consume a fair amount of energy to process raw ingredients into final products. Given the economic and environmental implications of intensive energy use — especially as related to energy derived from nonrenewable sources such as natural gas, coal or oil — we have implemented a wide array of energy reduction initiatives. These initiatives range from the recent installation of photovoltaic solar arrays at two of our facilities, to numerous simpler efficiency projects and equipment upgrades.

We will continue to seek out energy reduction opportunities across all our facilities and invest in the improvements that collectively reduce both our air emissions, including greenhouse gases (GHGs), and our operating costs. To aid in these efforts, we are in the process of compiling detailed energy use and GHG emissions information from our facilities. We expect to be able to report our baseline GHG inventory in 2010. At that time, we will also set more formal 2015 energy reduction goals.

Source: www.delmonte.com

PEPSICO

PepsiCo Receives 2010 ENERGY STAR® Sustained Excellence Award

PepsiCo, Inc., a leader in the food and beverage industry, is committed to making energy management a successful and integral part of its corporate sustainability efforts. This is the third time PepsiCo has received ENERGY STAR Sustained Excellence recognition. Key accomplishments include:

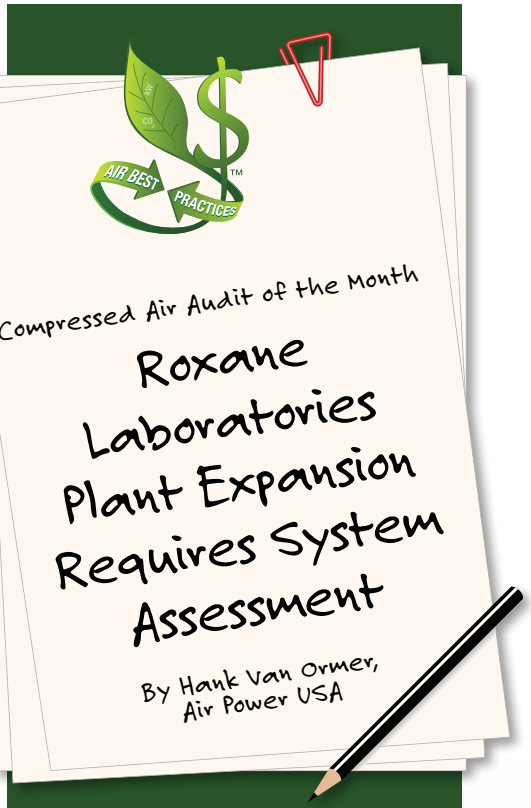
- Achieving a 36% improvement in energy intensity over the last 11 years and nearly a 1% reduction in energy intensity over the past year. PepsiCo's energy management efforts save the company over $80 million annually and prevented 570,000 metric tons of greenhouse gas emissions in 2009, which is equivalent to the energy consumption of more than 50,000 single-family homes in the United States
- Promoting energy management and ENERGY STAR to the company's suppliers, resulting in more than 90 of these companies becoming ENERGY STAR partners. As a result, PepsiCo's suppliers are now encouraging companies within their own energy value chains to manage energy use with ENERGY STAR
- Participating actively in EPA's ENERGY STAR Food Processing Focus and assisting in the development of two energy performance indicators for benchmarking the energy performance of plants producing baked cookies and crackers and fruit juices
- Developing and implementing energy projects that have a combined projected annual savings of more than $5 million in energy costs
- Organizing the PepsiCo Global Environmental Sustainability Summit where more than 400 of PepsiCo operations, contract manufacturing and franchise bottling associates from 15 countries convened for training and recognition for energy and sustainability achievements
- Implementing "RECON", a three-day training and energy assessment tool, in North American beverages operations to identify opportunities for improvement. Already, $7 million in utility improvements have been identified BP

Source: www.energystar.gov

THE SYSTEM ASSESSMENT OF THE MONTH

Roxane Laboratories Plant Expansion Requires System Assessment

BY HANK VAN ORMER, AIR POWER USA



May/June System Assessment of the Month

Company:	Roxane Laboratories
Location:	Columbus, Ohio
Industry:	Pharmaceutical
Issues:	Excessive energy costs Routine equipment failures Plant intends to expand production; the air system cannot increase delivered air
Audit Type:	Supply, Piping and Demand Side

System Assessment Win/Win Results

Annual Energy Costs Before Assessment:	$102,453
Annual Energy Costs After Assessment:	$42,139
Annual Energy Savings:	$61,314
Reduction in Electrical Energy:	1,156,868 kWh
Equivalent CO^2 Emissions:	824.84 metric tons
Equivalent CO^2 for Homes:	109 homes
Equivalent CO^2 for Vehicles:	151 vehicles

Roxane Laboratories, Inc., a subsidiary of Boehringer Ingelheim Corporation located in Columbus, Ohio, created a world-class air system that generated $61,314 per year in electrical energy cost savings (1,156,868 kWh), improved productivity and quality and enabled the successful completion of a significant plant expansion.

In early 2003, Roxane Laboratories, Inc., a subsidiary of Boehringer Ingelheim Corporation located in Columbus, Ohio, was charged with planning and implementing a major plant expansion to take place over the following five years. As plans progressed, the project team found that one of the most significant limitations to this expansion was the inability to increase air flow to the plant with their existing compressors. When plant personnel imposed a false additional demand on the system, the compressed air system could not hold the plant pressure, even with all the units running.

Roxane Laboratories contacted the service provider they used at that time (Air Power of Ohio), who called an independent compressed air consulting group, Air Power USA, Inc., from nearby Pickerington, Ohio.

Air Power USA's findings concluded that the basic piping configuration and sizing was limiting the system's ability to deliver any additional air from the compressor room to the plant. (See Figure 1)

Roxane Laboratories contracted with Air Power USA to conduct a complete review and audit of their system, including all the production areas on the demand side. They also requested a detailed plan to double the effective size of the air system and produce "a world class" compressed air system, which reflects the high quality standards of the company.

The Audit/Review Begins

Air Power USA personnel installed kW recording meters on each of the three air-cooled 125 horsepower class, 2-stage oil-free rotary screw compressors. Each of these units is capable of delivering 498 acfm (448 scfm) at 125 psig full flow pressure at 130.2 BHP (104 kW with a .93 ME motor). The actual measured input kW was: Unit #3 — 110 kW; Unit #4 — 109 kW; Unit #5 — 105 kW.

Air delivered to the system was measured and logged by a heated wire insertion flowmeter. Data was recorded and collected for seven days to capture all operating conditions. The plant runs 24 hours a day, 7 days a week, for 8,760 hours per year. There are many separate operations in production that are very well controlled. The flowmeter ranged from 650–1,250 scfm sustained peak with an average of 725 scfm.

The air compressors were equipped with 2-step, or load/no-load capacity controls, which operate on a 10 psig band (nominal 115–125 psig). The unit is at full load as the pressure (and input kW) increase along the band. At the unload point, the compressor inlet valve closes and the unit input kW falls to idle (24 kW).

The compressors capacity control system was set up in a typical cascade system, as shown in Figure 2. Reviewing the schematic in Figure 1, the units on line are #3, #4 and #5.

Figures 3 and 4 reveal trended kW measurement of three 125 hp units at Roxane Laboratories. All readings were taken simultaneously and are shown in two sets for clarity. However, you will note that Unit #5 is always at base load, and Unit #3 short cycles in trim. Unit #4 tries to load in but cannot, forcing Unit #3 to turn off. Unit #4 then takes over trim and short cycles.

The charts show the basic operation of the main compressed air supply units when running together.

- At any given time, only Unit #5 is on at full load during normal demand
- Unit #5 short cycled as pressure increased with significantly lower demand
- The trim Unit #3 continues to short cycle

THE SYSTEM ASSESSMENT OF THE MONTH

Roxane Laboratories Plant Expansion Requires System Assessment

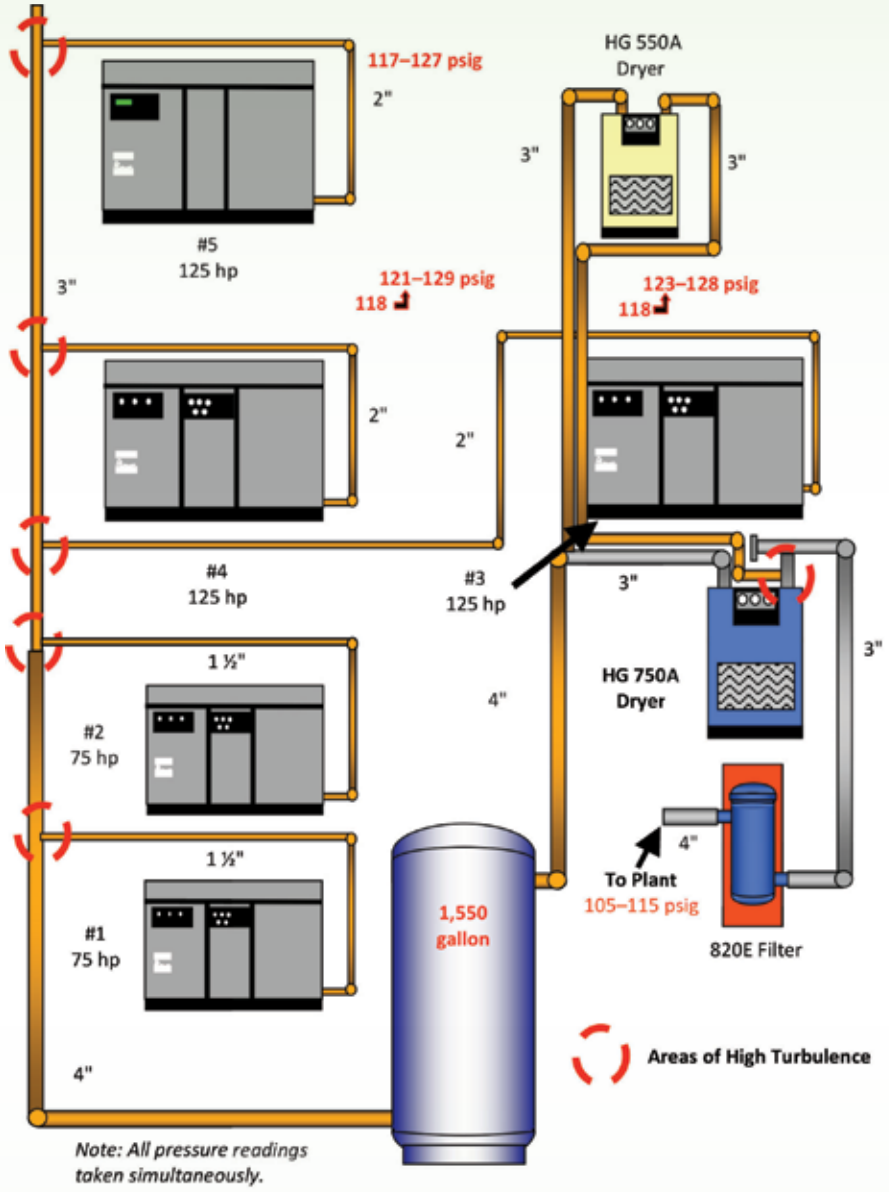


Figure 1
Roxane Laboratories Compressor Room

- A third Unit #4, called on due to falling plant pressure, comes on and goes off immediately
- Regardless of which unit was short cycling, it was only loaded about 30% of the time and operated at about 46% of full load input kW average
- The net result is 219 full load kW on-line and delivering 448 + (448 x .3) 582 scfm at 110 + (109 x .46) 160.14 input kW or 3.63 scfm/kW

Air Power USA identified the piping size (2" copper) discharge line to a 3" copper header. Although the resistance to flow of copper is less than black iron, the very high velocities (49 fps) in the 3" header trying to handle the load from each compressor, combined with the "crossing tee" configuration (Figure 5), creates very erratic and significant pressure spikes, causing the extreme short cycling. This short cycling was a principle cause of the premature airend, motor and cooler problems.

The other major problem that existed in the air supply was significant condensate carryover past the primary dryers where it had to be handled in a secondary trap area, requiring significant maintenance time to successfully protect the production area.

Air Power USA felt the primary problem here again was configuration, as the piping going from a 4" copper line in and out of a 1,550-gallon receiver was split into two 3" lines going to 550 scfm and 750 scfm rated non-cycling refrigerated dryers. The "crossing tee" where the 550 scfm dryer tried to feed into the discharge line from the 750 scfm dryer (see Figure 1), combined with long convoluted piping to the 750 scfm dryer, allowed very little compressed air flow through the 550 scfm dryer, thus often overloading the 750 scfm dryer and raising the pressure dew point and pressure loss.

The Air Power USA audit/review addressed these two very important issues, along with other compressed air efficiency projects:

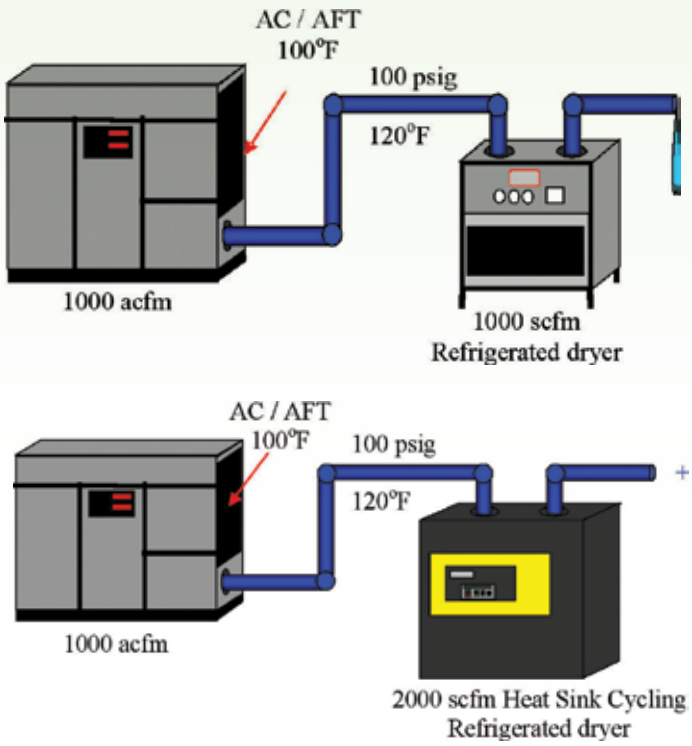
- Size system to be able to handle current 1,200 scfm demand plus an additional 800 scfm for 2,000 scfm at as low a pressure as 105 psig discharge pressure (100 psig system pressure)
- Lower compressors discharge pressure 18 psig for an 8–9% improvement in specific power
- Implement compressed air reduction projects (change air motors to electric, repair tagged leaks, replace open blows with venturi amplifier nozzles, reduce system pressure) for a total of 236 scfm (about 65 hp or 52 kW)
- Replace small non-performing non-cycling refrigerated dryers with a single, oversized, full heat sink-type cycling dryer

Enter the New System

After reviewing the final report, Roxane Laboratories engineering team decided to proceed to develop and implement the new "world class" compressed air system. Air Power USA was retained to assist the plant engineers in project management, with particular attention to the compressors and supporting equipment, including the piping material, sizing and configuration. URS Consultants of Columbus, Ohio was the mechanical engineering contractor. Joint meetings were held and following is an abbreviated list of specifications.

System Capability

- All components and total configuration to be sized to efficiently handle 2,000 scfm flow at a discharge pressure as low as 85 psig



THE SYSTEM ASSESSMENT OF THE MONTH

Roxane Laboratories Plant Expansion Requires System Assessment

Guidelines for Reconfigured Systems Design Parameters

- All new equipment to be watercooled
- Utilizing the existing air compressors and dryers as much as possible, recommend three different scenarios to reconfigure the system. If new equipment is recommended, identify the energy savings and their pertinent benefits
- A full networking central control system is required. This should keep all units at full load with one at trim, all others off. Control will limit the number of starts per hour to the proper amount. All units will be controlled automatically with an operating band of ±1–2 psig
- A monitoring system will also be part of the control system. The exportable critical data will be automatically disseminated
- Supply system to be redundant to N+1; the loss of any single largest unit to have 100% backup
- Explore benefits of demand side control system with large storage and pressure/flow controller. Evaluate energy savings and positive effects of a constant stable pressure on productivity and quality

Piping and Compressed Air Treatment

- The piping and compressed air treatment equipment will have characteristics rated at 2,000 scfm at pressures as low as 85 psig, not to exceed 20 fps pipeline velocities
- Interconnecting piping from the compressor discharge to, and from, the filter/dryer to create negligible pressure loss
- The coalescing pre-filter shall be sized to handle a flow rate of 2,000 scfm/minimum and still be effective at flows as low as 100 scfm or less. The filter should have a full load pressure loss of 1 psid or less when new and wet. Filter change is due at 3 psid or less and filter life must exceed one year with no particulate filter installed ahead. Manufacturer to state projected life
- The dryer is to be rated for 2,000 scfm flow rate at 100/100/100. It is to be a full cycling heat sink- or thermal mass-type refrigerated compressed air dryer capable of running with the refrigeration system only in direct response to actual heat load. Rated full load pressure loss not to exceed 3 psid
- Dryer refrigeration compressor starts should be limited to six starts per hour, based on the size and type of heat sink. The refrigeration compressor will shut off, not just unload. The design should be a "multi-module design" with multiple parallel refrigeration systems that can be valved out for repair or adjustment, and the dryer can continue to dry the air during that time, delivering N+1 redundancy without the need of a second or third unit

THE PROJECTED NEAR-TERM NEW DEMAND PROFILE AT 105 PSIG DISCHARGE PRESSURE WILL BE:		
Full production sustained peak	1,500 scfm	1,818 hours per year
Average full production	1,000 scfm	4,448 hours per year
Weekend and holidays production	550 scfm	2,496 hours per year

THE PROJECTED MAXIMUM DEMAND OVER THE 5-YEAR EXPANSION WILL BE:		
Full production sustained peak	2,000 scfm	1,818 hours per year
Full production average flow	1,500 scfm	4,448 hours per year
Weekends and holidays production	550 scfm	2,496 hours per year

These numbers were generated by the project team's operating model. After the system is fully reconfigured and stabilized, the plant will actively pursue lowering both the discharge (saving input energy) and the system pressure (reducing the flow demand) until they identify the optimum operating system pressure for maximum productivity and quality.

Figure 2

Other Basic System Support Items

- Central air management system operating from a single sensing point to hold all units at full load, except one at part load and all others off. The operating band to be ±2 psig with a maximum pressure loss from the compressor discharge to the distribution piping entry point of 5 psid
- Dew point meter after the dryer
- Flowmeter after the dryer
- Appropriate pressure gauges
- All measurement equipment installed in an appropriate manner for safe removal for service and calibration

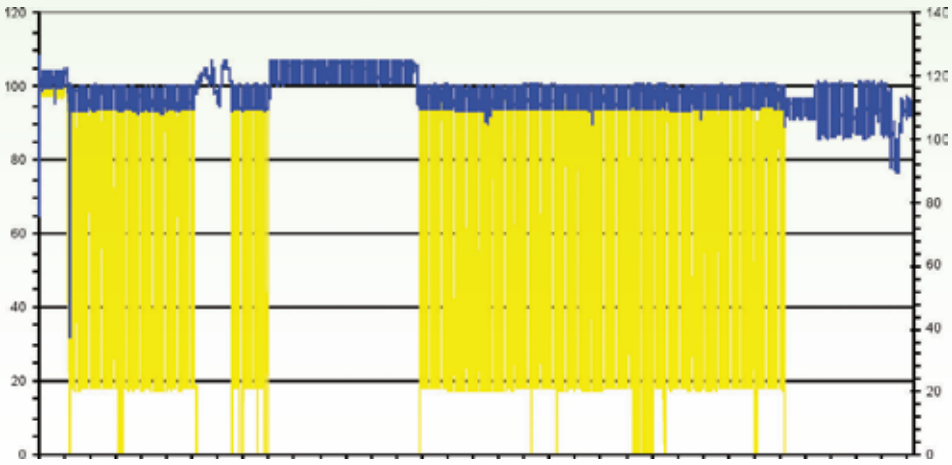


Figure 3
Roxane Laboratories Compressor Unit #3 and System Pressure

Selecting the Compressed Air Equipment

Working closely with Roxane Laboratories plant engineering and maintenance personnel, a complete matrix was developed with the four leading manufacturers of oil-free, 2-stage, rotary screw compressors. The following is a brief synopsis of the operating energy cost analysis:

- Today's air-cooled compressors are in relatively poor condition due to normal wear, exacerbated by the short cycling and heat caused by the installation piping and lack of proper ventilation and due to the cooling air ducting
  - Projected annual electrical energy cost to run today's units at the new demand = $137,377 per year
- There are two basic ways to approach a new compressed air supply:
  - Two large watercooled compressors 250 hp class with backup by the current 125 hp units
  - Multiple units to replace the existing five compressors, either all at once or one or two at a time

THE SYSTEM ASSESSMENT OF THE MONTH

Roxane Laboratories Plant Expansion Requires System Assessment

- Running two new 250 hp class units from any of the major manufacturers energy savings compared to running the current equipment at 2,000 scfm demand
  - Estimated maximum electrical savings = $16,727/year
- Running five smaller (150 hp) units compared to the current equipment at 2,000 scfm demand
- Supplying a VSD drive on these oil-free rotary offered very little, if any, energy savings when utilizing the very effective storage created by the piping and receiver
- Main electric drive motors were selected with a .95 (95%) motor efficiency in place of the current .93 (93%) — a 2% gain in specific power or an energy savings of: $2,740/year

After considering the other benefits, such as those listed below, the team selected the 250 hp size units.

- Fewer machines to maintain
- Less floor space required
- Two units will cover the project start and still have N+1 backup
- At the full demand, a third unit of the same size will complete the N+1
- Much simpler, more effective piping

Dryers and Pre-Filters

The change from air-cooled to water-cooled compressors will significantly improve the compressed air after-cooler's performance with regards to delivering compressed air to the dryer at 100 °F or less, and will greatly improve dryer performance. However, the team selected much more effective filters and refrigerated dryers that will improve performance, increase reliability and use less energy.

- Loose packed, deep-bed filter — estimated pressure loss <1 psid and 5–10 year life
- Loose-packed, deep-bed mist eliminators and other special filters will coalesce effectively throughout the total scfm range with very low pressure loss (<1 psid; change at 3 psid). Loose-packed, deep-bed mist eliminators (those with correct elements) have very high particulate load capacity (See Figure 6)

The project team also selected a heat sink-type full cycling refrigerated dryer which will handle low loads, as well as full loads, using only the appropriate amount of electrical input energy to condense the actual water vapor and then shut off.

There are several benefits and technical reasons to use an oversized, heat sink-type cycling refrigerated dryer:

- Low pressure drop: Probably less than 1 psid across the dryer at this flow to the system. On most high-quality cycling dryers, the full load pressure drop is less than 3 psig at full rated flow

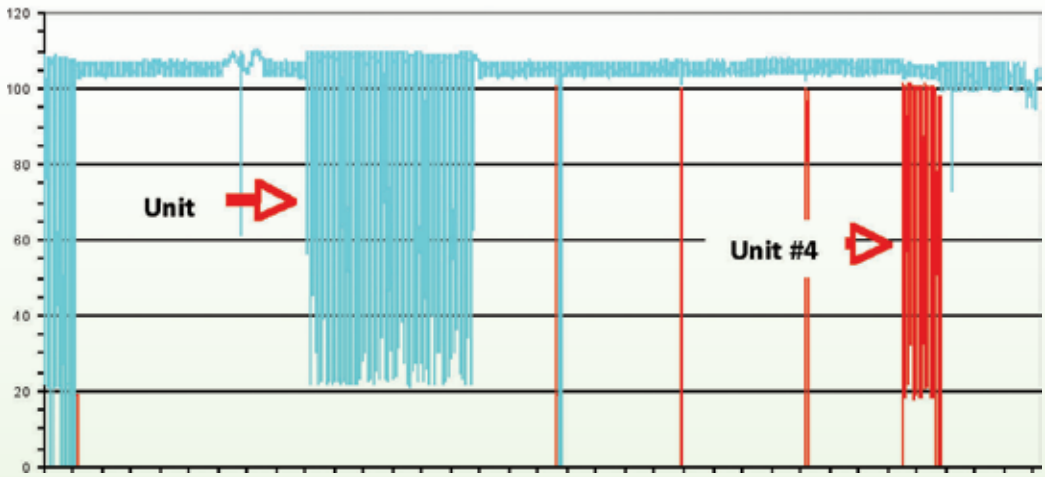


Figure 4
Roxane Laboratories Compressor Units #4 and #5 kW

- Heat sink refrigerated air dryers run fewer operating hours without the refrigeration compressor short-cycling problems. Utilizing a heat sink-type dryer designed to limit the starts and stops to a safe six times per hour or less means longer life
- A heat sink or thermal mass dryer cools down an internal glycol storage volume to a user-adjustable set point. Once it is cooled to this set point, the refrigeration unit(s) shut off. When the sensible heat raises the temperature of the glycol to the set point, the refrigeration compressor(s) will turn back on, cool it down, and then shut off again. We estimate that in Columbus, Ohio, the refrigeration compressor(s) will only run approximately 20% of the time. The other 80% of the time, they will be off. Glycol-based heat sink-type cycling dryers will be sized to limit the refrigeration compressors to six starts per hour or less. This is very critical to avoid refrigeration compressor/motor problems
- A stable low-pressure dew point: There are other advantages compared to a non-cycling or a variable-speed control dryer. Both the non-cycling and the VSD dryer will not shut off during low heat load, low demand periods. A hot gas bypass valve controls the non-cycling units. If it is not regularly adjusted correctly to fit varying operating conditions, it is possible to have freeze-up problems during low load conditions when set to hold a solid +40 °F pressure dew point during high loads. For this reason, significantly over-sizing a non-cycling dryer can lead to either constant required maintenance or freeze-up problems, and possible short cycling of the refrigeration compressors in larger units
- Multi-module design is comprised of several separate refrigeration systems that come on and off as needed. They also can be "valved out" individually to allow work on the separate module while the remainder of the dryer continues to run. This eliminates the need for a "back-up" dryer to accomplish low to zero down time

Savings

- Pressure loss filter/dryer combination at new projected load:
  Current: 10–13 psid
  Proposed:2–3 psid
  Savings of 8–10 psid discharge pressure (or about $6,165 per year in electrical energy savings) for the projected demand
- Not using the two existing refrigerated non-cycling dryers (plus one more 800 scfm class similar unit) and instead selecting a single 2,000 scfm rated full cycling dryer delivers an electrical energy savings of $3,871 per year

Continued on page 36

ENERGY INCENTIVES

BPA's Energy Smart Industrial Program

BY ROD SMITH, COMPRESSED AIR BEST PRACTICES®

Compressed Air Best Practices® Magazine interviewed Mr. Marcus Wilcox, President, Cascade Energy Engineering.

What is the relationship between the Bonneville Power Administration (BPA) and your firm, Cascade Energy Engineering (Cascade)?

Cascade was awarded the contract to collaboratively design and implement the BPA Energy Smart Industrial (ESI) program. The program was designed during the summer of 2009. Cascade is in charge of implementing the program, while BPA remains the overall manager, providing direction and oversight to Cascade. This is an innovative and unique way to design and run a program.

BPA is a power wholesaler and their customers are electric utilities. This program was designed with input from utilities that have different needs, end users and conservation goals. We therefore designed an "a la carte" menu of industrial program components for them.

Working together, we designed the BPA ESI program in four months, and launched it on October 1, 2009 to BPA utility customers in a total of eight states. We currently have 95 utilities signed up for the program. These utilities account for a very large percentage of the total industrial load served by BPA.

Please describe the overall objectives of the BPA Energy Smart Industrial Program.

According to Jennifer Eskil, BPA Industrial Sector Lead, "The purpose of the Energy Smart Industrial program is to assist BPA utility customers and their industrial facility customers in increasing cost-effective energy efficiency savings. The program is a primary mechanism for BPA utility customers to achieve industrial load energy savings targets of 12 aMW in fiscal year 2010, and 15 aMW in fiscal year 2011."

The BPA ESI Program serves the needs of both large and small utilities and large and small industrial customers, and it can address both new construction and retrofit capital projects. The ESI Program is also specific to electrical energy savings. It does not address natural gas savings and does not address demand response initiatives.

The program serves utilities and their respective end users with a diverse portfolio of capital projects, energy management, lighting and small project components. Obviously, compressed air is a significant target for this program. This is one of the most comprehensive and innovative industrial programs in the U.S. It is much more than incentives, offering high-performance technical assistance and cutting-edge energy management approaches.

How does the "Custom Projects" component of the BPA ESI Program work?

Custom Project Incentives cover the typical capital upgrade project. This could be for new construction or a retrofit project. An example of a retrofit is to replace existing inlet-throttled air compressors with a variable frequency drive (VFD) air compressors, or to install more energy efficient compressed air dryers.

Custom Project Incentive levels can pay up to 25 cents per kWh saved — up to 70% of the total project cost. There is no total dollar cap per project. Every project is closed out with an aggressive Measurement and Verification (M&V) process that documents final savings and cost. In most cases, detailed performance measurements (e.g., kW, pressure, control variables, etc.) are the basis for M&V. For new construction, calibrated modeling tools are utilized.

Describe the "Energy Management" component of the BPA ESI Program.

The "Energy Management" component has four different features — each addressing a unique need.

The first energy management feature is the Energy Project Manager (EPM). This addresses the significant shortfall of end user staffing capable of doing energy management. The incentive co-funds the hiring of an engineer to manage energy efficiency projects at a plant. For example, a pulp and paper mill could decide to hire an engineer with an $80,000 annual salary. The firm will also incur an estimated additional $30,000 in benefits and insurance costs. The EPM Incentive will co-fund these costs for the paper mill if they then deliver energy-saving projects.

The EPM Incentive will pay up to 2.5 cents per kWh of delivered savings capped at the end users loaded cost for that position ($110,000 in this example). The objective of the EPM Incentive is to drive the delivery of more energy-saving projects by overcoming the shortfall in qualified personnel on staff. Without this additional staffing, the projects simply would not happen.

What is the second feature of the "Energy Management" component?

The second energy management feature is Track and Tune (T&T). This feature pursues "no-cost and low-cost" Operations and Maintenance (O&M) energy-saving opportunities. An expert will review the facility or large sub-system for several days to identify these O&M action items. The facility will then implement the action items with in-house staff, contractors or vendors. System performance is tracked for up to five years to rigorously verify savings and document long-term performance. The long-term tracking helps prevent or correct backsliding in system performance.

The program pays for some or all of the cost of the expert review, a performance tracking system and implementation of the O&M opportunities (7.5 cents per kWh up to 70%). In addition, the program pays modest annual incentives during the 5-year tracking period (2.5 cents per kWh annually). We have a full-time person doing this tracking alongside the end user.

Please describe the HPEM feature.

The third feature of the "Energy Management" component is called High-Performance Energy Management (HPEM). The objective of this feature is to train the end user and help them implement strategic energy management. This can include one-on-one coaching of upper management, or networking groups of multiple end users so they can learn from one another. This creates a better corporate climate for energy efficiency and can directly deliver savings.

The goal of HPEM is to drive more energy efficiency projects and generate direct savings. The ESI program provides HPEM at no cost to the participating end users and in some cases may make annual payments of 2.5 cents per kWh for rigorously verified savings for a 5-year monitoring period.

ENERGY INCENTIVES

BPA's Energy Smart Industrial Program

> "The BPA ESI Program serves the needs of both large and small utilities and large and small industrial customers, and it can address both new construction and retrofit capital projects. The ESI Program is also specific to electrical energy savings."
>
> — Marcus Wilcox, President, Cascade Energy Engineering

What is the final and fourth component?

The ESI has two trade ally-driven offerings: Small Industrial (SI) and Northwest Trade Ally Network (NW TAN). SI is designed for small projects, such as compressed air 75 horsepower and smaller. We've developed an excellent calculator tool that provides quick assessments of key compressed air upgrades.

The calculator tool enables end users or vendors to fill in data about their pending projects and submit it to the ESI Program for review and approval. The objective is to be lean and mean and quickly generate energy savings in smaller applications, which can't justify the cost of on-site audits.

The ESI team conducts a QC review of the submission and provides quick approvals or denials on the application. These projects are treated the same as the Custom Projects as far as funding goes. That means that the Small Industrial Projects can qualify for up to 25 cents per kWh saved — up to 70% of the total project cost. There is no total dollar cap per project.

NW TAN is a comprehensive network of lighting vendors, distributors and contractors that collaborate to market and implement energy efficient lighting technology. The ESI program provides lighting specialists to work with utilities, end users and vendors to make lighting projects happen.

Please describe Cascade Energy Engineering.

Cascade Energy Engineering employs 50 people — 35 of whom are engineers. We have offices in Washington, Oregon and Utah. We also have "outpost" staff in Idaho and New York. We focus on industrial energy efficiency consulting and have been in business since 1993.

What services does your firm provide?

Cascade Energy Engineering provides three main categories of services to industry. First, we offer traditional project-oriented, energy-efficiency consulting for either retrofit or new projects. We serve every industry and every subsystem in facilities. The largest industrial users of energy in the Pacific Northwest are the pulp and paper and food processing industries.

We also provide energy management services. For example, we provide corporate energy management to Sysco Corporation, who has over one hundred food distribution warehouses throughout North America. This service includes:

1. Creating a corporate energy management strategy
2. Providing a web-based software tool to track monthly energy use. This includes real-time pulse meters so they can see their power profile, and on-line forums where users can talk.
3. Providing ongoing technical consulting for the facility. We will audit and review action items with plant personnel.
4. Doing a Kaizen Blitz (we also call them "tune-ups" or "commissioning") looking for low-cost or no-cost opportunities. When we do a tune-up at Sysco, we are there for two to five days. We send an Energy Engineer and a technician who is really experienced with lighting, battery chargers and ammonia refrigeration. Almost every food processor and warehouse uses ammonia refrigeration.

We have completed over two hundred of these tune-ups for Sysco and others. Sysco's kWh per cubic foot of storage space has dropped by one third since the energy management program started 2006.

Finally, we also provide utility energy efficiency program design and management services — like BPA's Energy Smart Industrial Program. For more information, see www.energysmartindustrial.com. BP

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THE TECHNOLOGY PROVIDER

Ultrasound Leak Tests Improve Heat Exchanger Quality for Food Processors

BY ALAN S. BANDES
VICE PRESIDENT, UE SYSTEMS, INC.

Ultrasonic leak detection has been used for a variety of applications ranging from energy reduction by locating compressed air leaks to quality assurance inspections, such as locating wind noise and water leaks in automobiles. The secret to success is to understand the nature of what type of leak produces a detectable ultrasound and what does not, along with the techniques that can be used for effective leak identification. Once understood, there are instances where the limits of detection can be enhanced to help locate a leak in difficult situations.

Typically, ultrasound leak detection is used to locate leaks where the pressure differential is enough to produce a turbulent flow as the gas moves from the high-pressure to the low-pressure side of a leak. Most often, any leak with a rate below 1x10-3 std. cc/sec will not generate a detectable, turbulent flow. For this reason, the majority of leak applications for ultrasound are limited to leaks above this threshold. One of the advantages of ultrasound is that leak detection is not limited to a specific fluid. The technology is open to identifying leaks in all types of gas, and even fluid, systems.

When confronted with a potentially difficult situation that involved locating low- level leaks in a particular shell-in-tube heat exchanger they were fabricating, Dan Rennert of Mason Manufacturing decided to investigate ultrasound. Having used the technology for a previous employer, Dan was aware of the potential for success, as well as for the downsides. He understood that ultrasound instruments detect a turbulent flow, and that to produce this turbulence, the flow rate would have to be in excess of some of the types of leaks he suspected he'd need to find. He had performed a standard hydrostatic test on the exchanger and did locate several leaks, but felt there might be more, smaller leaks present.

Mason Manufacturing fabricates a variety of pressure vessels and heat exchangers for chemical, food and grain processors. Some of their clients are very demanding in terms of the quality of products they order. They expect Mason Manufacturing to deliver a leak-free product and Mason, in turn, pursues all options to meet these demands.

One of the advantages of ultrasound is that leak detection is not limited to a specific fluid. The technology is open to identifying leaks in all types of gas, and even fluid, systems.

THE TECHNOLOGY PROVIDER

Ultrasound Leak Tests Improve Heat Exchanger

Dan considered utilizing helium testing, which he felt would find smaller leaks than ultrasound typically can sense. His concerns were two-fold: namely, the proximity of the tubes and time it would take to identify the leaks. Typically, helium detection is time consuming in that the sensor has to be carefully manipulated around the test area. In addition, there is the potential for confusion should the helium from one site drift to the sensor as it is scanning an adjacent site. In this instance, the tubes in the heat exchanger were in close proximity. There was a ⅜" distance between tubes, which could make identification of a particular leaking tube difficult. This was a large exchanger with over 8,000 tubes in a 15–16' diameter tube sheet, with the tubes extending several inches from the tube sheet. The time it would take to manipulate a sensor around this configuration could take days for completion.

Since Dan had decided to investigate the use of ultrasound leak detection for this application, he consulted with Mr. Mark Goodman, VP of Engineering at UE Systems. Mr. Goodman agreed with Mr. Rennert's concern that the leaks might not produce enough detectable ultrasound since they were slow forming and low level. He suggested that they use a method called "Liquid Leak Amplification". This incorporates the use of a surfactant with low surface tension. The heat exchanger is pressurized and the liquid is applied to sections of the tube sheet. This is similar in nature to the typical "bubble test", but with one exception. The fluid used has low surface tension so that a low-flow leak will form a bubble that will burst almost immediately, producing a detectable ultrasound. Standard soap and commercially formulated bubble test solutions, when used on low-level leaks (typically below 1x10-3 cc/sec), will take a much longer time to form bubbles and an even longer time for the bubble to burst. Plus, with unusual configurations such as in this case where the tubes extended beyond the tube sheet, the bubbles would not be seen and therefore the leak would not be detected.

Mr. Rennert decided to try the Liquid Leak Amplification method. He pressurized the heat exchanger to about 50 psi, and sprayed the Liquid Leak Amplifier on four-foot square sections of the exchanger tube sheet. It is usual with this procedure to have a number of bubbles form upon contact with the tube sheet, so he waited until the initial formation of bubbles subsided. Dan then plugged in the scanning module and began to scan along the tube sheet section with the ultrasonic sensor. He repeated this process of spaying the liquid onto one four-foot section at a time, waiting and scanning. He identified the leaks by detecting what he describes as a slow "pop-pop" sound occurring about 1–2 seconds apart. While he did not see the bubbles, he was able to confirm the leak by noting that the popping sounds did not occur around any adjacent tubes. It took him only eight hours to complete the scan of 8,000 tubes. Three leaks were identified, in addition to those he had located previously with the hydrostatic test.

Convinced that he had found and repaired all the leaks, he sent the heat exchanger to his customer. It would have been extremely expensive for their customer if they had a leak in the heat exchanger, since the leak would have contaminated their product. With this procedure, Mason was able to deliver a leak-free heat exchanger to a very satisfied customer.

Ultrasonic leak detection has been used for a variety of applications ranging from energy reduction by locating compressed air leaks to quality assurance inspections, such as locating wind noise and water leaks in automobiles.

THE TECHNOLOGY PROVIDER

Ultrasound Leak Tests Improve Heat Exchanger

For the future, Dan anticipates using ultrasound for large exchangers to be sure the gaskets are tight. They will use it before a hydro test on these exchangers. As Dan explained, "If you have an exchanger that's 10–11' diameter and fill it up with water, that's a lot of water." Dan estimates that this will save them many gallons of water. His procedure will be to add 5 psi of air after the gasket has been installed, and test with Liquid Leak Amplifier.

Since Dan had used the ultrasound equipment previously in a chemical plant testing for steam leaks, he was familiar enough with the technology to adapt it to his current position. He anticipates using ultrasound in their shop to cut energy waste by locating air leaks. In fact, he recently walked along one area in his plant near a wall and found leaks in the airline, a crack in the housing of an air dryer and another leak in an air hose.

A few words of caution — any method established for leak detection has its benefits and its limitations. Leak detection is generally "hard work". It requires knowledge of the test subject, test conditions and an understanding of the type of leak to be detected. For example, is it a liquid or a gas? Is it a slow-forming leak or a high-flow leak? Once understood, then the inspector must decide on the technology and method best suited for the particular leak. It also requires strategy for preparation, safety, application, identification and confirmation of the leak. Some types of testing might need to conform to specific codes and standards. In addition, a method for leak management must be implemented so that the leaks are not only identified, but also repaired and re-checked for quality assurance. BP

For more information, please contact UE Systems at www.uesystems.com or Tel: 800.223.1325.

The secret to success is to understand the nature of what type of leak produces a detectable ultrasound and what does not, along with the techniques that can be used for effective leak identification. Once understood, there are instances where the limits of detection can be enhanced to help locate a leak in difficult situations.

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FINDING AND FIXING LEAKS

BY RON MARSHALL, PDC COMMITTEE MEMBER, COMPRESSED AIR CHALLENGE®

Participants of the **Compressed Air Challenge® Fundamentals of Compressed Air Systems** seminar learn about the high cost of producing compressed air and the inherent inefficiencies in the compressor room. Understanding the supply side of the system is important, but more important is first looking at compressed air demand. One demand that is consistently in need of attention in industrial facilities is the air flow caused by leaks.

The CAC® training stresses the importance of baselining plant leaks and doing leak surveys. "Leak surveys are important because they normally offer the largest demand side opportunity," says Chris Beals, a compressed air system design consultant and Certified CAC® instructor. "During leak surveys, we recommend collecting sufficient data so the leaks can be sorted by location and by the component that is leaking. This additional information allows personnel to determine where to focus their efforts and how to best rectify leaks."

"First, a plant engineer or maintenance supervisor must realize that leak repair is a journey, not a destination. An ongoing compressed air leak monitoring and repair program should be in place in any plant that has a compressed air system," explains Paul Shaw, a general manager for Scales Industrial Technologies' Air Compressor Division and an Advanced CAC® Instructor. "Leak identification and remediation with a high- quality repair can lead to substantial energy savings that typically have a very rapid payback, usually a year or less," he continues. "In the hundreds of leak audits and repairs that we have done, we've found that the quality of the repair is critical to ensuring the customer receives the most value for his investment and that the leak remains repaired for as long as possible. From there, constantly monitoring for compressed air leaks and repairing them as they occur can help the plant continue to reap the energy benefits."

In addition to the seminar, **Compressed Air Challenge®** has a wealth of information on leaks and other related issues and is available for download at our **website library**. The following is an excerpt from "**Best Practices for Compressed Air Systems**", Appendix 4.E.1. This 325-page manual is available at our **bookstore**.

The Compressed Air Challenge® (CAC) is pleased to announce the second version of Fundamentals of Compressed Air Systems WE (web edition) on May 14, 2010. Led by Frank Moskowitz and Tom Taranto, this web-based version of the popular Fundamentals of Compressed Air Systems training uses an interactive format that enables the instructor to diagram examples, give pop quizzes and answer students' questions in real time. Participation is limited to 25 students. Please visit the CAC® web site today (www.compressedairchallenge.org) to access online registration and for more information about the training.

If you have additional questions about the new web-based training or other CAC® training opportunities, please contact the CAC® at info@compressedairchallenge.org or call 301-751-0115.

A good compressed air system leak repair program is very important in maintaining the efficiency, reliability, stability and cost effectiveness of any compressed air system.

Finding and Fixing Leaks and Establishing a Leak Prevention Program

Leaks can be a significant source of wasted energy in an industrial compressed air system, sometimes wasting 20–30% of a compressor's output. A typical plant that has not been well maintained will likely have a leak rate equal to 20% of total compressed air production capacity. On the other hand, proactive leak detection and repair can reduce leaks to less than 10% of compressor output.

In addition to being a source of wasted energy, leaks can also contribute to other operating losses. Leaks cause a drop in system pressure, which can make air tools function less efficiently, adversely affecting production. In addition, by forcing the equipment to cycle more frequently, leaks shorten the life of almost all system equipment (including the compressor package itself). Increased running time can also lead to additional maintenance requirements and increased unscheduled downtime. Finally, leaks can lead to adding unnecessary compressor capacity.

FINDING AND FIXING LEAKS

CAC Qualified Instructor Profile

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Half of Chris's 30 years in the compressed air industry were spent as owner of a compressor distributorship in Denver, Colorado. Since selling his distributorship in 1998, Chris has been active as a consultant, designing compressed air systems and conducting compressed air system audits and seminars throughout North America and Europe. As a member of the Compressed Air Challenge®, he is one of five members of the Core-Technical Group, which wrote the material contained in the Compressed Air Challenge® seminars. In addition, he has written many articles for trade magazines.

There are two types of air leaks — planned and unplanned. The planned air leaks are the ones that have been designed into the system. These leaks are the blowing, drying, sparging, etc. used in the production process. Many times, these have been installed as a quick fix for a production problem. Some leaks take the form of "coolers", which are used to cool production staff or equipment. The CAC® document, "**Potentially Inappropriate Uses of Compressed Air**" at our web site has more detail on planned leaks.

The unplanned leaks are ongoing maintenance issues and can appear in any part of the system. These leaks require an ongoing air leak detection and repair program. While leakage can come from any part of the system, the most common problem areas are:

- Couplings, hoses, tubes and fittings — tubes and push-to-lock fittings are common problems
- Disconnects — O-rings required to complete the seal may be missing
- Filters, regulators and lubricators (FRLs) — low first-cost improperly installed FRLs often leak
- Open condensate traps — improperly operating solenoids and dirty seals are often problem areas
- Pipe joints — missed welds are a common problem
- Control and shut-off valves — worn packing through the stem can cause leaks
- Point-of-use devices — old or poorly maintained tools can have internal leaks
- Flanges — missed welds are a common problem
- Cylinder rod packing — worn packing materials can cause leaks
- Thread sealants — incorrect and/or improperly applied thread sealants cause leaks. Use the highest-quality materials and apply them per the instructions

Estimating the Amount of Leakage

For compressors that have start/stop controls, there is an easy way to estimate the amount of leakage in the system. This method involves starting the compressor when there are no demands on the system (when all the air-operated end-use equipment is turned off). A number of measurements are taken to determine the average time it takes to load and unload the compressor. The compressor will load and unload because the air leaks will cause the compressor to cycle on and off as the pressure drops from air escaping through the leaks. Total leakage (percentage) can be calculated as follows:

$$\text{Leakage } (\%) = [(T \times 100)/(T + t)]$$

Where: T = on-load time (minutes)
t = off-load time (minutes)

Leakage will be expressed in terms of the percentage of compressor capacity lost. The percentage lost to leakage should be less than 10% in a well-maintained system. Poorly maintained systems can have losses as high as 20–30% of air capacity and power.

Leakage can be estimated in systems with other control strategies if there is a pressure gauge downstream of the receiver. This method requires an estimate of total system volume, including any downstream secondary air receivers, air mains and piping (V, in cubic feet). The system is started and brought to the normal operating pressure (P1). Measurements should then be taken of the time (T) it takes for the system to drop to a lower pressure (P2), which should be a point equal to about one-half the operating pressure.

Leakage can be calculated as follows:

Leakage (cfm free air) =
(V x (P1-P2)/T x 14.7) x 1.25

Where: V is in cubic feet
P1 and P2 are in psig
T is in minutes

The 1.25 multiplier corrects leakage to normal system pressure, allowing for reduced leakage with falling system pressure. Again, leakage of greater than 10% indicates that the system can likely be improved. These tests should be carried out quarterly as part of a regular leak detection and repair program.

Leak Detection

Since air leaks are almost impossible to see, other methods must be used to locate them. The best way to detect leaks is to use an ultrasonic acoustic detector, which can recognize the high-frequency hissing sounds associated with air leaks. These portable units consist of directional microphones, amplifiers and audio filters, and usually have either visual indicators or earphones to detect leaks.

"Leak identification and remediation with a high-quality repair can lead to substantial energy savings that typically have a very rapid payback, usually a year or less."

— Paul Shaw, a General Manager for Scales Industrial Technologies' Air Compressor Division and an Advanced CAC® Instructor.

CAC Qualified Instructor Profile

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Currently a general manager for Scales Industrial Technologies' Air Compressor Division, one of the nation's leading compressor distributors, Paul Shaw has more than 29 years in the compressed air industry, in positions that have included: engineering, sales, sales management, service technician and service management.

In his career in the compressor industry, he has saved more than a thousand small, medium and large companies millions of dollars in wasted compressor energy by improving compressor and dryer efficiency, and he is particularly adept at reducing demand through proper compressed air management and process and production machinery improvements. He has performed more than 250 major compressed air assessments and leak surveys, from which he brings many real life examples and solutions to help participants gain the most from his seminars.

Mr. Shaw contributed to and is an instructor for both Fundamentals and Advanced Compressed Air System Training. He consults for and speaks regularly to many engineering organizations, corporations and utilities on the subject of compressed air and energy efficiency.

FINDING AND FIXING LEAKS

Ultrasonic leak detection is probably the most versatile form of leak detection. Due to its capabilities, it readily adapts to a variety of leak detection situations. The principle behind ultrasonic leak detection is simple: In a pressure or vacuum leak, the leak flows from a high-pressure laminar flow to a low-pressure turbulence. The turbulence generates a white noise, which contains a broad spectrum of sound, ranging from audible to inaudible frequencies. An ultrasonic sensor focuses in on the ultrasonic elements in the noise. Since ultrasound is a short wave signal, the sound level will be loudest at the leak site. Ultrasonic detectors are generally unaffected by background noises in the audible range because these signals are filtered out. This means leaks can be heard in even the noisiest environments.

The advantages of ultrasonic leak detection include versatility, speed, ease of use, the ability to perform tests while equipment is running and the ability to find a wide variety of leaks. They require minimum training, and operators often become competent within 15 minutes.

Due to the nature of ultrasound, it is directional in transmission. For this reason, the signal is loudest at its source. By generally scanning around a test area, it is possible to very quickly hone in on a leak site and pinpoint its location. For this reason, ultrasonic leak detection is not only fast, it is also very accurate.

How to Fix Leaks

Leaks occur most often at joints and connections at end-use applications. Stopping leaks can be as simple as tightening a connection or as complex as replacing faulty equipment such as couplings, fittings, pipe sections, hoses, joints, drains and traps. In many cases, leaks are caused by bad or improperly applied thread sealant. Always select high-quality fittings, disconnects, hoses and tubing and install them properly with appropriate thread sealant.

Non-operating equipment can be an additional source of leaks. Equipment no longer in use should be isolated with a valve in the distribution system.

Another way to reduce leaks is to lower the demand air pressure of the system. The lower the pressure differential across an orifice or leak, the lower the rate of flow, so reduced system pressure will result in reduced leakage rates. Stabilizing the system header pressure at its lowest practical range will minimize the leakage rate for the system.

Once leaks have been repaired, the compressor control system should be re-evaluated and adjusted, if necessary, to realize the total savings potential.

Establishing a Leak Prevention Program

A good leak prevention program will include the following components: identification (including tagging), tracking, repair, verification and employee involvement. All facilities with compressed air systems should establish an aggressive leak reduction program. A cross-cutting team, involving decision-making representatives from production, should be formed.

A leak prevention program should be part of an overall program aimed at improving the performance of compressed air systems. Once the leaks are found and repaired, the system should be re-evaluated.

A good compressed air system leak repair program is very important in maintaining the efficiency, reliability, stability and cost effectiveness of any compressed air system.

Note: A more comprehensive explanation of how to establish a leak prevention program appears in the Best Practices for Compressed Air Systems. Get yours today! BP

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THE SYSTEM ASSESSMENT OF THE MONTH

Roxane Laboratories Plant Expansion Requires System Assessment

Continued from page 19

The New System is Complete

The project team developed the final overall layout and design (reflected in Figure 7) in 2004, and implementation was underway. Some key points to observe as shown on this schematic are:

- Discharge line size is now 3" going to an 8" header
- The piping material is stainless steel, which is much more resistant to damage from the highly acidic condensate from an oil-free air compressor than copper or black iron
- Most connections were welded, but some were fitted with Victaulic fittings and Viton seals for maximum life and flexibility in the future
- All connections to the header used angled direction entry to avoid high turbulent-driven backpressure
- All risers and other drain points have "zero loss" automatic condensate drains
- Room was left for an additional filter, dryer and compressor if/when the system grows to or exceeds 2,000 scfm
- The large storage tank for dry air, before the pressure/flow controller, has compressed air entering the receiver with one line and going to the pressure/flow controller and system with another; the air goes through the receiver
- The initial pressure settings were discharge pressure of 115 psig and regulated flow to the system of 105 psig
- The project was complete and everything went as planned. Actually, the initial pressure loss in 2004, when the system was set up from the compressor discharge to the pressure flow controller, was 1–2 psig

Where We Are in 2009 – five years into the mission:

- There have been no significant failures or repairs on the primary compressor or dryer/filters
- The filter has not needed changing
- Compressor discharge pressure has been reduced to 125 psig and system pressure to 105 psig
- The growth in demand has not yet reached the 2,000 scfm plateau due to effective plant air management and conservation programs and to operating at a lower production distribution header pressure. However, the second (or trim) unit runs routinely during production, which triggers a need for the third compressor to continue the N+1 reliability factor
- Air Power USA, in conjunction with plant engineering, ran several compressor operating-efficiency models comparing a constant speed trim unit to a VSD trim unit. In 2004, the constant speed was a slightly lower operating cost than a VSD. In 2009, with the now-current data, the VSD generated a slightly lower operating cost. In order to achieve this, the VSD would have to be in trim all the time. The plant decided to select a third compressor with the same specification as the two existing units

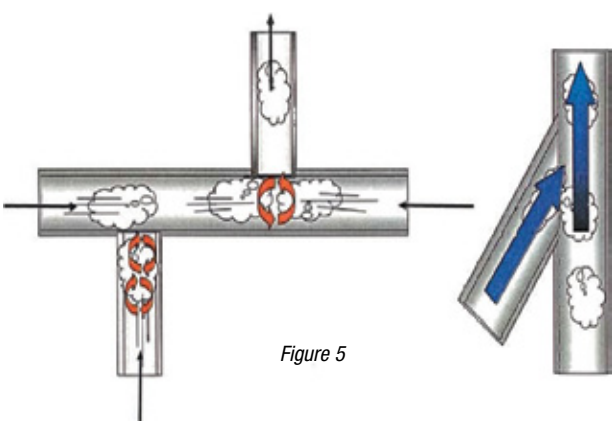


Figure 5

Figure 6
Loose-packed, deep-bed coalescing filter and standard coalescing filter

Summary

The new "world class" air system has performed as designed with high-performance and extremely high-reliability of all the selected equipment. The system was designed to handle a maximum of 2,200 acfm (2,000 scfm) without any major changes. Today, it is running about 300–500 scfm below that.

If it ever gets to the point where a third unit is needed routinely, it will still perform well, but in a diminishing manner. If the growth increases to where the three units have to run together most of the time (2,800–3,000 scfm), then consideration will be given to a complete revaluation of the entire supply and demand system as to pipe sizing, storage, regulation of flow, dryer, primary air, etc.

Overall, this story is a great example of why it is best to do the audit or review BEFORE you make significant changes or expansions to the air system. A job well done, and still paying off 5 years later! BP

For more information, please contact Hank Van Ormer, Air Power USA, Tel: 740-862-4112, email: hank@airpowerusainc.com, www.airpowerusainc.com.

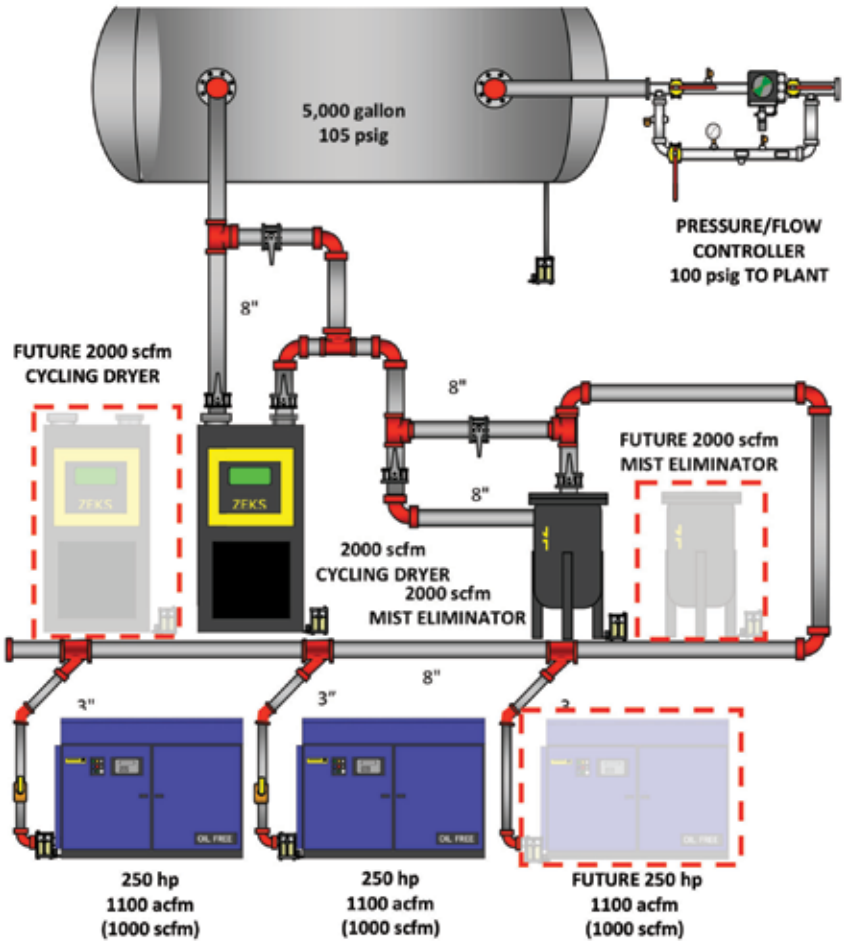


Figure 7
New Compressed Air System

THE PNEUMATIC ADVANTAGE

Reducing Packaging Cycle Times of Interdental Flossers

BY PHIL O'NEILL, STANDARD PRODUCTS MANAGER, BOSCH REXROTH PNEUMATICS

Swiss brush company Ebnat-Kappel uses non-contact transfer technology from Bosch Rexroth to automate a problematic section of its packaging production process.

Have you ever tried to pick up one single plastic bag from a pile, only to find that the bags "stick" to each other, so instead of taking just one, you lift up one or two others as well? At Ebnat-Kappel AG, a Swiss manufacturer of high-quality brushes, the ability to efficiently separate, lift and open plastic bags is a crucial step in the production process of the interdental flosser packaging machine. However, automating this step of the packaging process proved extremely difficult. The plastic bags could not be individually lifted and opened by applying conventional vacuum technology.

Despite the difficulties, the Ebnat-Kappel AG brush factory, known by their brand name "Ebnat Switzerland", still wanted to automate this complicated section of the packaging process and fill their Interdental Flossers into bags. "In such a situation, it's hard to know what to do," remembers Gottfried Kaufmann, purchasing team manager at the brush specialists. "Packaging interdental flossers into plastic bags was just impossible with standard vacuum lifters, and this is why we tested handling with the Non-Contact Transfer (NCT) unit from Bosch Rexroth."

Lifting Force Generated by a Vacuum

The NCT allows non-contact material handling. It lifts objects without any surface contact at all. What looks like magic is, in fact, based on a physical law: the Bernoulli principle (see sidebar for more information). The air flow under the NCT generates a vacuum and creates a lifting force between the NCT and the object with a minimum air pocket between them. The transport unit operates at pressures from 1–7 bar (15–102 psi), and is ideal for applications where handling of porous or permeable workpieces, objects with rough or dusty surfaces, or soft materials, such as the plastic bags from the Ebnat-Kappel brush factory, is required.

"We need two NCTs each with a 60-millimeter diameter for our application," explains Gottfried Kaufmann. Each of the NCT60s delivers 6.0 Newton lifting force at 5 bar (73 psi). A longitudinal conveyor and filling funnel are used to prepare the interdental flossers for packaging. A pile of empty plastic bags is located at the bottom of the machine. The first NCT moves in from the right-hand side and lifts a bag from the top of the pile. The NCT is then rotated by 90° into a vertical position with a swivel arm.

The air flow on the second NCT on the left is then generated to open the bag so that it can be filled from above with brush parts. The NCT on the left then drops the bag by deactivating the air flow that generates the vacuum and returns to its starting position. Finally, the NCT attached to the swivel arm releases the filled bag onto a conveyor belt and also returns to its original position.

Successful Tests

The entire process appears quite simple, but it poses hidden difficulties. "We tested other technical solutions for this handling job. However, we discovered that these plastic bags are just not compatible with other technologies, particularly vacuum lifters," emphasizes Kaufmann. "When applying the vacuum technology, we found that it was sucking in dirt and causing the plastic bags to crease. Both of these disruptive factors have to be excluded when packaging the interdental flossers.

The NCT was the only solution we could use — without it, we could never have automated this step of our production process."

This traditional brush specialist with modern production facilities for approximately 1000 different products was already familiar with the NCT through a presentation. "We first tested the NCT with 0.3–0.5 millimeter-thick cardboard boxes for blister packaging with perforations, as well as with beakers for travel toothbrush sets. Lifting proved no problem at all, which was confirmed in another test with floor mops which we conducted with three NCT40s," confirms Kaufmann. He adds,

"We observed outstanding results with tests on the plastic beakers. While standard vacuum lifters left slight marks on the smooth surface, the NCT left none at all during handling."

Fast Packaging on Order

The NCT appealed to decision-makers at the Ebnat-Kappel brush factory, who were open to this new solution, particularly as the two non-contact transport units achieve cycle times of five to ten seconds to fill the plastic bags. Gottfried Kaufmann emphasizes that, besides solving the handling task, speed was also a vital factor: "We only supply these interdental flossers on order, which means that they have to be packaged as fast as possible. The trouble-free separation and opening of the plastic bags plays an important role here."

The NCT allows non-contact material handling. It lifts objects without any surface contact at all. What looks like magic is, in fact, based on a physical law: the Bernoulli principle.

THE PNEUMATIC ADVANTAGE

Reducing Packaging Cycle Times of Interdental Flossers

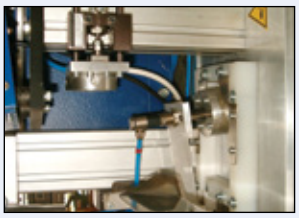
Carried by Air — The Bernoulli Principle

Daniel Bernoulli (1700–1782), a Dutch-born Swiss scientist, discovered the principles of hydrodynamics and studied fluid flow. From these studies, he deducted the physical law known today as the "Bernoulli principle" which states that as the speed of a moving fluid (gas or liquid) increases, the pressure within the fluid decreases. In accordance with the Bernoulli principle, the entire energy within a stationary flow is constant throughout the entire flow path. As a result, the increase in the flow speed is always accompanied by a decrease in pressure.

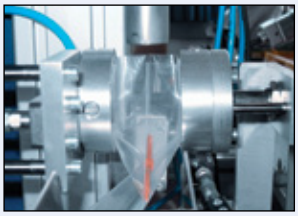
The principle also describes the flow along surfaces. An airplane wing is designed so that the air moves faster over the upper wing surface than along the lower surface. This effect generates a lower pressure on the upper surface than on the lower surface. The differential pressure causes the airplane to stay in the air. Water propellers also have a similar structure to a wing. As a propeller rotates, it generates a differential pressure between the front and back of the blade which propels the ship or airplane. You can test the principle yourself in a simple experiment by holding one sheet of paper over another and blowing air between them. BP

For more information contact Phil O'Neil,
Bosch Rexroth Pneumatics,
Tel: 859-254-8031,
email: Phil.Oneill@boschrexroth-us.com.

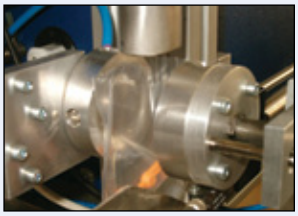
To fill the plastic bags with interdental flossers, the dental hygiene products are transported along a longitudinal conveyor and filled into the bag through a funnel. The individual bags first have to be lifted and opened cleanly without creasing.



The first NCT60 positions itself above the pile of plastic bags. By generating a vacuum with the air flow, it lifts the bag on top of the pile without any contact and rotates it by 90° into a vertical position.

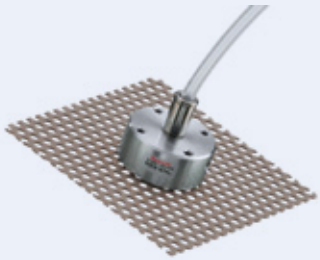


Once the first NCT is holding the bag vertically, the second NCT moves in to open the plastic bag. An air pocket between the NCT and object lifts and opens the bag without any surface contact at all.



In contrast to vacuum lifters, the NCT technology does not suck in any dirt or crease the plastic bag and ensures smooth handling of the packaging bags.

Lifting, opening and filling one plastic bag with interdental flossers takes just five to ten seconds. By employing two NCT60s, this process at the Ebnat-Kappel AG brush factory could be automated and is now fast and efficient.



The NCT is suitable for even the most difficult handling tasks, capable of lifting porous, permeable or soft workpieces, and objects with rough or dusty surfaces.

The air flow under the NCT generates a vacuum which serves as a lifting force to "hold" objects without touching them. The transport unit is ideal for tasks where direct contact with the object's surface is just not possible

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RESOURCES FOR ENERGY ENGINEERS

TRAINING CALENDAR

TITLE	SPONSOR(S)	LOCATION	DATE	INFORMATION
Ultrasound World VI Conference	UE Systems	Clearwater Beach, FL	5/10-14/10	www.uesystems.com Tel: 301-751-0115 www.compressedairchallenge.org
Compressed Air Challenge® Fundamentals of Compressed Air Systems	Compressed Air Challenge®	Web-based	5/21/10 5/28/10 6/4/10 11-1 pm EST	info@compressedairchallenge.org
Compressed Air Challenge® Fundamentals of Compressed Air Systems	Manitoba Hydro Compressed Air Challenge®	Winnipeg, MB	10/26/10	Veronica Walls Tel: 204-360-7229 email: vwalls@hydro.mb.ca www.compressedairchallenge.org
Compressed Air Challenge® Advanced Mgmt of Compressed Air Systems	Manitoba Hydro Compressed Air Challenge®	Winnipeg, MB	10/27-28/10	Veronica Walls Tel: 204-360-7229 email: vwalls@hydro.mb.ca www.compressedairchallenge.org

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Pressure Transmitter for Industrial Applications

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msmith@wika.com, www.wika.com

PRODUCT PICKS

New Cycling Compressed Air Dryers

Sullair Corporation introduced its new SSRC Refrigerated Cycling Compressed Air Dryer. The SSRC Dryer is furnished in nine models, ranging from 175–1000 scfm. These dryers utilize energy-saving R404A scroll refrigeration compressors, standard on SSRC-400 to SSRC-1000 models. Other standard features on these dryer include a unique zero-loss drain integrated into the heat exchanger to collect condensate. As condensate builds, it activates a drain level sensor to evacuate collected material. The drain cycle continually adjusts itself to working conditions.

The dryers feature a high-capacity demister separator. Designed to remove condensed liquids, the demister lowers the air velocity that maximizes the separation of condensate, even when the dryer is not operating at maximum flow. The dryers are designed with oversized condensers to allow operation up to 140 °F (60 °C) air inlet and 115 °F (46 °C) high ambient temperatures.

A control program ensures the lowest dew points at all times. While cycling dryers typically control only the thermal mass temperature, the SSRC monitors both the thermal mass and dew point temperatures, allowing better dew point control and load variation anticipation.

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RESOURCES FOR ENERGY ENGINEERS

PRODUCT PICKS

Data Logger Selection Guide

Those seeking best-match technology for monitoring temperature, humidity, pressure or electronic signal events can now use the online step-by-step resource guide available from Dickson Company, who offers the widest selection of data loggers and chart recorders for these monitoring purposes. The Dickson Data Logger Selection Guide can be accessed at http://www.dicksondata.com/article/article_61.php.

Multiple selection factors are provided, including instrument displays, remote probe availability, alarm options, wireless/Ethernet/battery-operated or outlet-powered, operating ranges and cost. Users are able to drill down and mix and match various features until they identify the range of instruments that match their specifications.

Chris Sorensen, Dickson VP Sales and Marketing, comments, "We know that the data logger or chart recorder that is the best fit for one user's application may not work well for another, and we maintain the world's widest selection of top-quality instruments to ensure you'll never have to make do with a less-than-optimal instrument match to your application."

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Two Compressors in One Cabinet

Kaeser announced an innovation in progressive air system technology — the new two-in-one HSD air compressor. It is the first of its kind featuring two independently operating compressors in a single enclosure. These new packages are available from 500–650 hp, and deliver flows from 1632–3002 cfm and pressures from 100–217 psig.

Each HSD incorporates two individual compressor units including a motor, Sigma Profile airend, separator aftercooler, draintrap and filtration. Because each module is a complete compressor — and not just two airends stacked together — the HSD provides maximum part-load efficiency, built-in redundancy and reduced installation costs.

HSD compressor units are started one after another to reduce inrush current and protect against network overload. Both compressor units have dedicated Sigma Controls, connected via Profibus, for energy efficient sequencing and fully automatic monitoring of critical operating and maintenance indicators. Plus, with the Sigma Frequency Control option, the HSD is not only the largest variable frequency drive in its class, but it also doubles the flow range of previous models.

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LITERATURE & SERVICES PICKS

The Compressed Air System Solution Series©

Scot Foss has provided his expertise to many of the world's leading manufacturing and processing corporations by finding solutions to their problems. Foss is one of the world's leading experts in compressed air systems, known for his sometimes-controversial approach to the issues that face plant engineers, maintenance managers and production engineers.

Written in a conversational format, this 1,100-page book with 165 illustrations brings you solutions with a straight on, common sense approach supported by technology. The author focuses on concepts and applications, which are guaranteed to improve production results and energy efficiency. The chapters of the book are as follows:

1. Change Your Way of Thinking about Compressed Air
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3. Troubleshooting the System
4. Instrumentation and Information Management
5. Compressed Air Storage and Using Potential Energy
6. Piping and Piping Systems
7. Compressor and System's Controls
8. The Business of Demand
9. Supply Energy
10. Cleaning Up Compressed Air
11. Standards and Specification

The cost of the book is $195.99. To order the book, make a check or PO out to: Air's a Gas, Inc., 3728 Berenstain Drive, St. Augustine, FL 32092, or call 904-940-6940, fax 904-940-6941 or e-mail: airsagas@aol.com. A portion of the proceeds from this book will be donated to selected children's charities.

New Edition of "Best Practices for Compressed Air Systems®" from the Compressed Air Challenge®

The Compressed Air Challenge® has released the Second Edition of their authoritative "Best Practices for Compressed Air Systems®."* The Best Practices manual provides tools needed to reduce operating costs associated with compressed air and to improve the reliability of the entire system. The 325-page manual addresses the improvement opportunities from air entering the compressor inlet filter, through the compressor and to storage, treatment, distribution and end uses, both appropriate and potentially inappropriate. Numerous examples of how to efficiently control existing and new multiple compressor systems are provided in one of the many appendices.

The Best Practices manual created by the Compressed Air Challenge® begins with the considerations for analyzing existing systems or designing new ones. The reader can determine how to use measurements to audit their own system, how to calculate the cost of compressed air and even how interpret electric utility bills. Best practice recommendations for selection, installation, maintenance and operation of all the equipment are included in each section. BP

**The Best Practices for Compressed Air Systems® manual is a product of the Compressed Air Challenge®, co-authored by Bill Scales and David McCulloch and is not associated with Compressed Air Best Practices® Magazine.*

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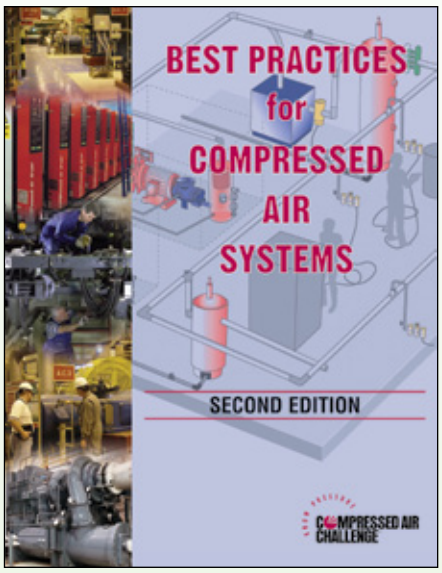


WALL STREET WATCH

BY COMPRESSED AIR BEST PRACTICES®

The intent of this column is to provide industry watchers with publicly held information, on publicly held companies, involved with the sub-industry of compressed air. It is not the intent of the column to provide any opinions or recommendations related to stock valuations. All information gathered in this column was during the trading day of May 3, 2010.

MAY 3, 2010 PRICE PERFORMANCE	SYMBOL	OPEN PRICE	1 MONTH	6 MONTHS	12 MONTHS	DIVIDEND (ANNUAL YIELD)
Parker-Hannifin	PH	$69.87	$65.40	$53.15	$46.18	1.50%
Ingersoll Rand	IR	$37.54	$35.65	$31.60	$21.80	1.05%
Gardner Denver	GDI	$50.42	$45.76	$35.89	$27.24	0.40%
United Technologies	UTX	$75.26	$74.32	$61.71	$49.62	2.27%
Donaldson	DCI	$46.37	$45.85	$35.75	$33.07	1.04%
SPX Corp	SPW	$70.38	$67.42	$53.24	$46.71	1.43%

Donaldson Announces Fiscal 2010 Second-Quarter Earnings

Donaldson Company, Inc. (NYSE: DCI) announced its financial results for its fiscal 2010 second quarter. "Our operating income increased 40%, as our operating margin improved to 9% from 6% last year," said Bill Cook, Chairman, President and CEO. "We benefited from the savings generated by our restructuring activities and our ongoing product and process cost reduction initiatives. Our sales mix also helped to improve margins, as our replacement filter sales again exceeded our first-fit sales."

"While we had very strong operating performance in the quarter versus last year, our net earnings and EPS were down due to the incremental tax benefits of $11 million received last year."

"We were also very pleased that our sales were better than we had anticipated and that for the third consecutive quarter, were up on a sequential basis. With the continued improvement in our overall business conditions, combined with the benefits from our completed cost reduction and restructuring activities, we expect both our sales and earnings comparisons to be positive for the second half of FY10."

"One key benefit of our diversified portfolio of filtration businesses is the variety of our different end-market exposures. We have already seen our early-cycle businesses return to year-over-year growth, including Aftermarket and On-Road Products in our Engine Products, and Special Applications in our Industrial Products. Some of our mid-cycle businesses are now stabilizing. As global economic conditions continue to improve, we expect more of our businesses to return to year-over-year growth."

Financial Statement Discussion

Gross margin was 33.5% for the quarter and 34.1% year-to-date, compared to prior year margins of 29.1% and 31%, respectively. The increase in our gross margin was the result of a higher mix of replacement filter sales, savings from our restructuring actions and ongoing cost reduction activities. Within gross margin, we incurred $3.4 million in restructuring costs in the quarter, compared to $2.4 million last year.

Operating expenses of $106.9 million for the quarter were essentially flat with the prior year. Year-to-date operating expenses were $202.9 million, down 9.1% from $223.2 million in the prior year. We incurred $1.7 million in restructuring costs in the quarter, compared to $1.9 million last year. Warranty expense increased by $3.2 million compared to last year's second quarter.

FY10 Outlook

Based on recent economic data and customer forecasts, we expect continued gradual improvement in overall business activity. Our updated full year FY10 EPS forecast has been increased to be between $1.77 and $1.97, including our estimated full year restructuring costs of $12–$17 million.

- We are planning our total FY10 sales to be $1.8 billion. Our forecast is based on the Euro at US$1.37 and 90 Yen to the US$
- Including our estimated full year restructuring costs, we expect our full year operating margin to be 11.4–12%
- Our full year FY10 tax rate is projected to be between 26–28%
- We expect our full year free cash flow to be $145–$165 million

Industrial Products: We forecast full year FY10 sales to decrease 8– 12%, including the impact of foreign currency translation.

- Our Industrial Filtration Solutions Products' sales are projected to decrease 8–12% for the year as improving demand for replacement filters is offset by continued lower demand for new filtration equipment
- We expect full year sales of our Gas Turbine Products to decrease 25–30% due to the current slowdown in demand for large power generation projects. Our longer-term outlook remains positive, with the eventual recovery of the global economy and the increased availability of natural gas

Special Applications Products' sales are projected to increase 10–14%, as conditions have improved in the end markets for both our disk drive filters and membrane products.

Parker Hannifin Announces Fiscal 2010 Second-Quarter Earnings

Parker Hannifin Corporation (NYSE: PH) reported results for the fiscal 2010 second quarter ending December 31, 2009. Fiscal 2010 second quarter sales were $2.4 billion, an increase of 5.3% compared with the first quarter of fiscal 2010 and a decline of 12.4% from $2.7 billion in the second quarter a year ago. Fiscal 2010 second quarter net income was $104.6 million, an increase of 42.3% compared with the first quarter of fiscal 2010 and a decline of 32.7% compared with $155.4 million in the second quarter of fiscal 2009. Cash flow from operations for the first six months of fiscal 2010 was $606.3 million, or 13.2% of sales, compared with $444.5 million, or 7.7% of sales in the same prior year period.

WALL STREET WATCH

"This quarter's results largely reflect the execution of our Win Strategy, including the benefits of actions we have taken to restructure our operations since the recession began," said Chairman, CEO and President Don Washkewicz. "Notably, our performance has improved significantly relative to the first quarter of the year. Considering that our second quarter is typically our weakest, our margin performance this quarter was most impressive with decremental margins at just 10.6%. Total segment operating margins exceeded 10% at this low point in the cycle and were equal to last year. These are strong indicators that we are managing through this unprecedented downturn very effectively."

"Although the effects of the global recession continue to linger, we are encouraged to see Parker's order trends improve sequentially for the second consecutive quarter. Organic sales declined approximately 16% in the quarter, while foreign currency translation positively impacted sales by approximately 4%. Operating cash flow year to date of 13.2%, another critical measure of our performance, was well above our targeted level of 10%. Our strong cash performance and balance sheet management throughout the recession has enabled us to pay down our outstanding debt by approximately $1 billion in the past twelve months, bringing our current debt-to-debt equity ratio below 30% and further strengthening our balance sheet."

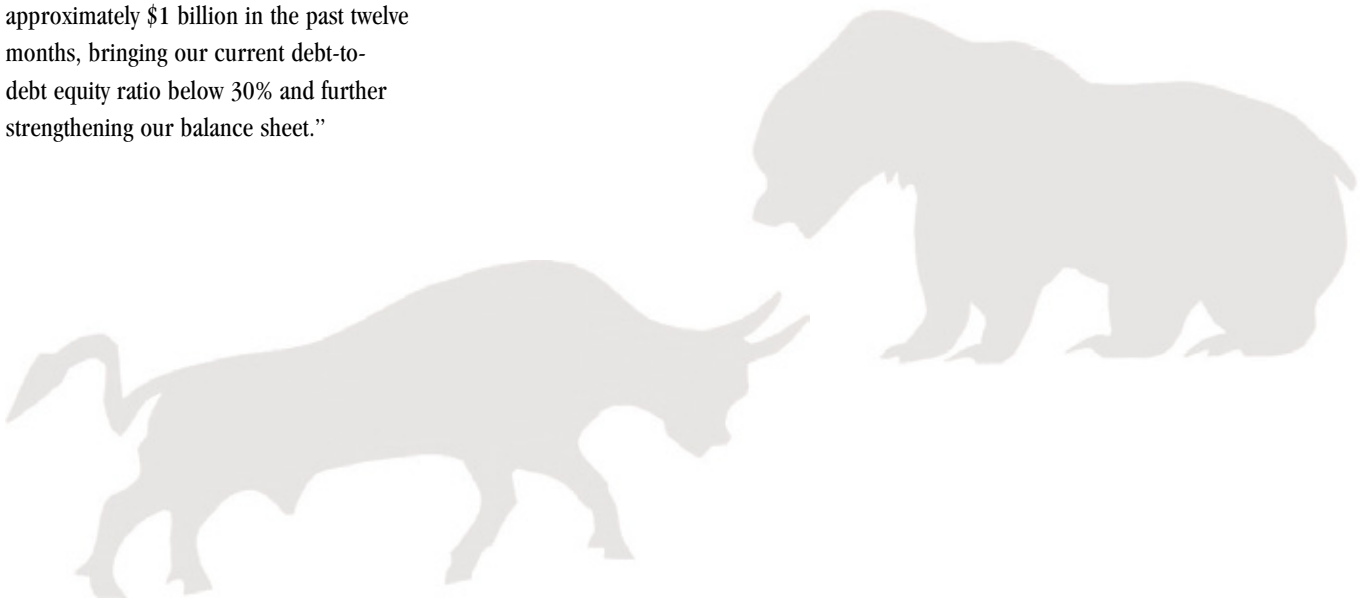
Segment Results

- In the Industrial North America segment, second quarter sales declined 14.7% to $847.2 million, and operating income increased 6.3% to $114.4 million, compared with the same period a year ago
- In the Industrial International segment, second quarter sales declined 10.6% to $932.1 million, and operating income declined 28.2% to $82.6 million, compared with the same period a year ago
- In the Aerospace segment, second quarter sales declined 15.4% to $400.6 million, and operating income declined 41.1% to $41.0 million, compared with the same period a year ago
- In the Climate and Industrial Controls segment, second quarter sales declined 2.4% to $174.9 million, and operating income increased 147.9% to $6.1 million, compared with the same period a year ago

Orders

In addition to financial results, Parker also reported a decline of 7% in total orders for the quarter ending December 31, 2009, compared with the same quarter a year ago. Parker reported the following orders by operating segment:

- Orders declined 3% in the Industrial North America segment, compared with the same quarter a year ago
- Orders were unchanged in the Industrial International segment, compared with the same quarter a year ago
- Orders declined 27% in the Aerospace segment on a rolling 12-month average basis
- Orders increased 6% in the Climate and Industrial Controls segment, compared with the same quarter a year ago



Outlook

For fiscal 2010, the company has increased its guidance for earnings from continuing operations by 44% to the range of $2.40 to $2.80 per diluted share.

Washkewicz added, "With our actions to drive strong margin and cash flow performance taking full effect, and what we believe to be the early signs of a recovery emerging, we are anticipating a strong second half to our fiscal year and have raised our guidance appropriately. Our priorities will remain unchanged as we progress through this fiscal year focused on executing the Win Strategy and managing for cash while simultaneously targeting strong margin performance. Parker's management remains proud of our worldwide team of employees who has made these results possible. As the recovery unfolds, Parker's leading market position, global scale and balance, end market breadth and solid financial and operational fundamentals position us well for profitable growth." BP

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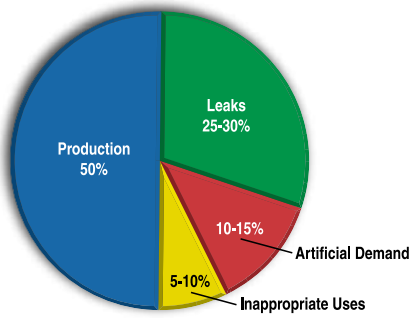

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