P.E.T. Compressors Visteon Energy Management AICD Report

July 2011

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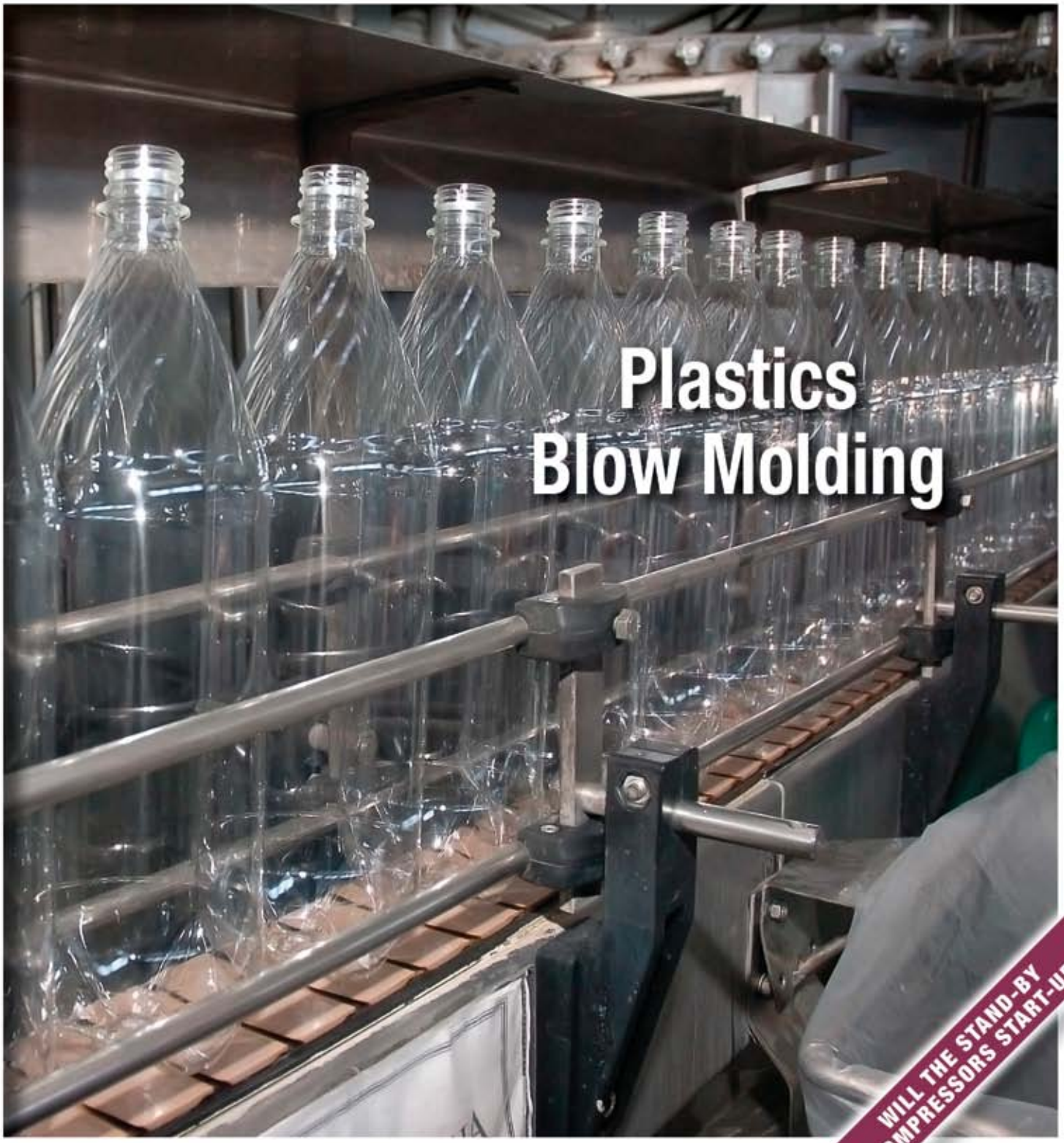

Plastics Blow Molding

WILL THE STAND-BY COMPRESSORS START-UP?

Clear the way for quality air

Sustainable Productivity

Hi, I'm Michelle and I have been working with our customers across the United States for the last 10 years. Products that optimize quality in your air supply are not just accessories we offer; they are a way of life for us at Atlas Copco. That's why we produce such a wide variety of dryers, aftercoolers, filters and oil-mist eliminators just to name a few.

We all perform best when working within our optimum environment, right? And, manufacturing environments are no different. Moisture in your air supply is something that should be avoided at all costs. Water is a by-product of compressing air. But there are ways to ensure this moisture doesn't get downstream and cause equipment malfunction. And more importantly, moisture can lead to contamination of your end products, leading to costly product failures and potentially harming your hard-earned reputation.

Our mission is to continue to bring sustainable productivity through safer, cleaner, more energy-efficient, and cost-effective compressed air technology. Simply log onto **www.atlascopco.us/michelleusa** or call **866-688-9611** to learn more about us, our products, and how we have earned and will continue to earn our reputation.

Atlas Copco

HITACHI COMPRESSOR CENTENNIAL ANNIVERSARY 2011

Celebrating 100 Years of Compressed Air Technology

1910 1950 1970 1980 1990 2000 2011

1911

2011

•1910: First product was a 5 HP electric motor, Hitachi was founded

•1911: 75kW Reciprocating - First Compressor in Japan

•1946: First Bebicon

•1954: Oil Free 22kW Reciprocating

•1967: Oil Free Bebicon

•1968: First Oil Free Rotary Screw DS Series

•1969: First Oil Free Rotary Screw DS Series

•1976: Oil Injected Packaged Rotary Screw Series

•1977: Smallest 5.5kW Oil Injected Rotary Screw

•1980: First DSP Series Oil Free Rotary screw

•1981: Vortex Blower "E" Series

•1982: World's Smallest Single Stage Oil Free Rotary

•1985: World's First Oil Injected Scroll Bebicon

•1986: World's Smallest Air Cooled Oil Free Rotary

•1992: Vortex Blower "G" Series

•1995: Oil Free Scroll SRL Series

•2002: New Generation Oil Injected HISCREW2000 Series

2009:• New Oil Free Scroll SRL Series Multiplex

•2000: World's First Variable Speed Drive Oil Free Rotary

•1999: New Generation Oil Free Rotary Screw DSP Series

•2001: Package Scroll Bebicon

•2005: New Oil Free Scroll SRL Series

Leading Innovation over the last 100 years, Hitachi is proud to recognize the past and present milestones of air technology. It is with this foundation that we continue our growth for the next 100 years. Please join us in our centennial celebration as we strive to provide the most reliable, environment friendly and energy conscious products.

Hitachi Oil-Less Scroll SRL Series Compressors

Hitachi Oil-Free Screw DSP Series Compressors

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Inspire the Next

SUSTAINABLE MANUFACTURING FEATURES


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FROM THE EDITOR

Plastics Blow Molding Industry

Heat recovery systems, of air compressors, provide factories with excellent opportunities to reduce the energy costs associated with their boiler systems. In this month's system assessment, Gary Wamsley details how he discovered a significant downside to heat recovery ducting – it caused backup air compressors not to start due to low oil temperatures during the winter. Read how he solved the problem.

Once the workhorse of industry, double-acting reciprocating air compressors have found a strong niche as the air compressor technology of choice for the P.E.T. bottle blowing industry. Don Oitker, a retired veteran of reciprocating air compressors, spent some time speaking with people from Gardner Denver's Bellis & Morcom division – a leading manufacturer of these air compressors.

Jennifer Meier, Visteon's Global Energy & Engineering Manager, spent some time with me this month describing the initiatives to save energy at her corporation. Visteon is a leading automotive component manufacturer and has done very well to move their energy management program forward internationally through the use of webinars and best practice communication platforms.

Our unofficial guru for the plastics industry, Dean Smith of iZ Systems and for the Compressed Air Challenge, writes about "Compressed Air Efficiency Opportunities in the Plastics Industry." The article focuses on the real costs of higher system pressures (in the blow molding process) and the sources of artificial demand.

The 2011 AICD Conference & Exhibition was again a very educational and entertaining event. Held in Las Vegas, the exhibitor and attendee turnout was very strong and we write an article about "what we saw".

We hope you enjoy this edition. Thank you for your support and for investing in *Compressed Air Best Practices*®.

ROD SMITH
Editor
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rod@airbestpractices.com

"A back-up air compressor would not start-up. The problem was related to the heat recovery ducting. Learn how the problem solved in the System Assessment story."

— Rod Smith

SUSTAINABLE MANUFACTURING NEWS

Energy Star and DOE ITP News

SOURCED FROM THE WEB

ENERGY STAR Program Helps Cement Industry Improve Energy Efficiency, Shift Performance Curve

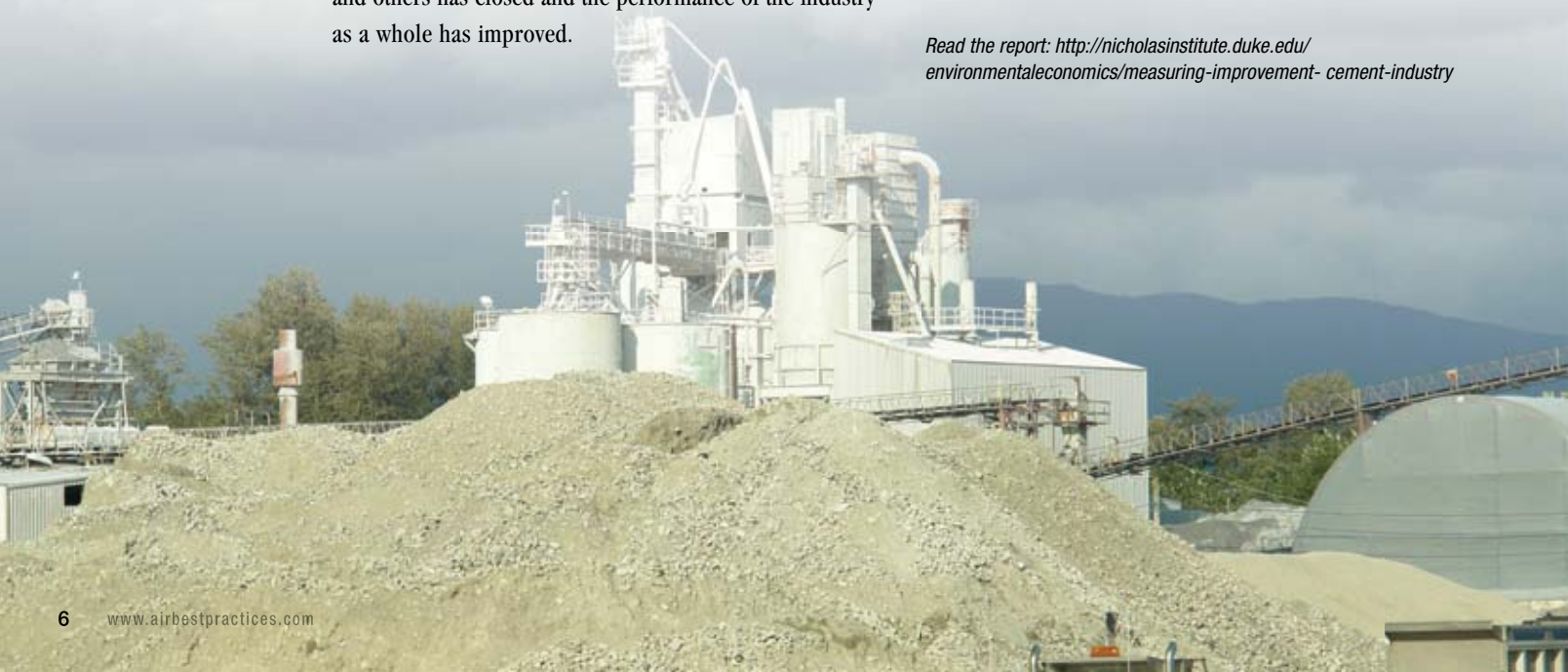
A new report by the Nicholas Institute for Environmental Policy Solutions at Duke University affirms that the ENERGY STAR program has helped improve the energy efficiency of the cement manufacturing industry, which has cut its energy intensity by 13% over a decade. This improvement is equivalent to a total source energy use reduction of over 60 trillion Btu and an annual emissions reduction of almost 1.5 million metric tons of energy-related carbon, according to the report. Cement manufacturing is very energy intensive, and the improvements represent a substantial shift in the industry's energy efficiency curve.

The report, *Measuring Improvement in the Energy Performance of the U.S. Cement Industry,* validates EPA's energy management strategy, particularly the importance of performance measurement and recognition for top performance. The report also demonstrates that the gap between top performing cement manufacturing plants and others has closed and the performance of the industry as a whole has improved.

Central to this energy management approach is the ENERGY STAR Energy Performance Indicator (EPI) for cement plants, which enables industry to benchmark plant energy performance against peers and over time. ENERGY STAR EPIs exist or are under development for more than 20 industries. Manufacturing plants that have earned EPA's ENERGY STAR certification save more than 245 trillion Btu, nearly $1.5 billion in utility costs, and nearly 4.5 million metric tons of carbon annually.

The U.S. cement industry produces goods valued at over $10.6 billion and employs nearly 18,000 persons. The U.S. industrial sector accounts for 30% of energy use in the United States. If the energy efficiency of industrial facilities improved by 10%, EPA estimates that Americans would save over $14 billion and reduce greenhouse gas emissions equal to the emissions from the electricity use of more than 20 million homes for a year. Hundreds of industrial companies are working with EPA's ENERGY STAR program to develop strong energy management programs, earn ENERGY STAR certification for their plants and achieve breakthrough improvements in energy efficiency.

Read the report: http://nicholasinstitute.duke.edu/environmentaleconomics/measuring-improvement- cement-industry



EPA Awards ENERGY STAR Certification to First Container Glass Plants

EPA is recognizing the first container glass plants to earn ENERGY STAR certification. The first ENERGY STAR certified container glass plants include three Verallia North America plants, owned by Saint-Gobain, located in Pennsylvania, Indiana, and Massachusetts. Compared to average container glass plants, these ENERGY STAR certified container glass plants annually save 1.3 million Btus of energy, avoid about $7.5 million in energy bills, and prevent the emission of nearly 61,000 metric tons of carbon dioxide equivalent, equal to the emissions from the electricity use of more than 7,000 homes for one year. Plants verified to be in the top 25% of performance nationwide may be eligible for ENERGY STAR certification.

EPA Awards ENERGY STAR Certification to First Cookie and Cracker Bakeries

EPA is recognizing the first cookie and cracker bakeries to earn ENERGY STAR certification. The first thirteen ENERGY STAR certified bakeries are owned by Lance Private Brands, Richmond Baking of Indiana, Oak State Products, Bremner Food Group, and the Kellogg Company. Compared to average plants, these thirteen ENERGY STAR certified bakeries save 4,300,000 million Btus of energy, avoid nearly $24 million in utility bills, and prevent more than 85,000 metric tons of carbon dioxide equivalent annually, equivalent to the emissions from more than 16,000 cars. Plants verified to be in the top 25% of performance nationwide may be eligible for ENERGY STAR certification.

U.S. DOE LEADER Companies Listing

The following *Save Energy Now* LEADER Companies made a pledge to reduce their energy intensity by 25% or more in 10 years.

SIGNED *SAVE ENERGY NOW* LEADER COMPANIES

COMPANY NAME	INDUSTRY TYPE
3M	DIVERSIFIED HOLDING COMPANY
Alcoa	ALUMINUM MANUFACTURING
Amcor PET Packaging	PACKAGING, CONTAINERS
Arkema	CHEMICALS
AT&T	TELECOMMUNICATIONS
Ball Packaging North America	PACKAGING, CONTAINERS
Bentley Prince Street, Inc.	BUILDING MATERIALS
Bic Graphic USA	ADVERTISING, MARKETING
BPM, Inc.	FOREST & PAPER PRODUCTS
Bradken	METALS
Bridgestone Tire	INDUSTRIAL EQUIPMENT
Briggs & Stratton	INDUSTRIAL EQUIPMENT
Brown Printing Company	PUBLISHING, PRINTING
Buckeye Technologies, Inc.	CHEMICALS
CalPortland	BUILDING MATERIALS, CEMENT
Cargill Regional Beef of Milwaukee	FOOD PRODUCTION
Carlton Forge Works	METALS
Carus Chemical Company	CHEMICALS

SUSTAINABLE MANUFACTURING NEWS

Energy Star and DOE ITP News

SIGNED *SAVE ENERGY NOW* LEADER COMPANIES

COMPANY NAME	INDUSTRY TYPE
Chippewa Valley Ethanol Company	PETROLEUM REFINING
Cook Composites and Polymers Co.	BUILDING MATERIALS
Cummins, Inc.	INDUSTRIAL EQUIPMENT
Dahlgren & Company, Inc.	FOOD PROCESSING
Danfoss	INDUSTRIAL EQUIPMENT
Davisco Foods	FOOD PRODUCTION
Denison Industries	METAL CASTING
Dexter Foundry	METAL CASTING
Didion Milling	FOOD PRODUCTION
Dow Chemical Company	CHEMICALS
DSM North America	DIVERSIFIED HOLDING COMPANY
Duke Manufacturing Company	BUSINESS EQUIPMENT MANUFACTURING - HOSPITALITY
Earth2O	BEVERAGE MANUFACTURER AND BOTTLING
Eastman Chemical Corporation	CHEMICALS
Eaton Corporation	INDUSTRIAL EQUIPMENT
Eck Industries	METAL CASTING
Flambeau River Papers	FOREST & PAPER PRODUCTS
Florida's Natural Growers	BEVERAGES
Flying Foods Group	FOOD PRODUCTION
General Dynamics Ordnance and Tactical Systems	AEROSPACE AND DEFENSE
General Motors	MOTOR VEHICLES & PARTS
Goodyear Tire and Rubber Company, US Tire Plants	MOTOR VEHICLES & PARTS
Gorell Windows & Doors	CONSTRUCTION, DOORS AND WINDOWS
Grand River Printing	PUBLISHING, PRINTING
Graphic Packaging International	PACKAGING, CONTAINERS
Gray's Harbor Paper	FOREST & PAPER PRODUCTS
Harrison Steel	METAL CASTING
Haynes International	METALS
HNI Corporation	HOME EQUIPMENT, FURNISHINGS
Holcim (US) Inc.	BUILDING MATERIALS, CEMENT
Huntsman Corporation	CHEMICALS
Ingersoll Rand	INDUSTRIAL EQUIPMENT
Intel	INFORMATION TECHNOLOGY
Johnson & Johnson	PHARMACEUTICALS
JR Simplot	FOOD PRODUCTION
Kenworth Truck Company	MOTOR VEHICLES & PARTS
Legrand North America	ELECTRICAL EQUIPMENT MANUFACTURING
Lockheed Martin	AEROSPACE AND DEFENSE
Lufkin Industries, Inc.	METAL CASTING
Manitowoc Grey Iron Foundry	METAL CASTING
Mannington Mills	TEXTILE
McCain Foods USA, Inc.	FOOD PRODUCTION
MeadWestvaco (MWV) - Specialty Chemicals Division	CHEMICALS
MedImmune	VACCINE PRODUCTION
Metal Industries, Inc.	METALS
Mohawk Industries	HOME EQUIPMENT, FURNISHINGS
National Semiconductor	SEMICONDUCTORS AND OTHER ELECTRONIC COMPONENTS
Neenah Foundry	METAL CASTING
Nissan North America	MOTOR VEHICLES & PARTS
OMNOVA Solutions, Inc.	CHEMICALS
Opto 22	ELECTRICAL EQUIPMENT
Osram Sylvania	ELECTRICAL EQUIPMENT
Owens Corning	BUILDING MATERIALS, GLASS
Owens-Illinois, Inc.	PACKAGING, CONTAINERS
Patrick Cudahy	FOOD PRODUCTION
PepsiCo	FOOD PRODUCTION
PPG Industries	CHEMICALS, GLASS
Procter & Gamble	HOUSEHOLD AND PERSONAL PRODUCTS
Quad/Graphics, Inc.	PUBLISHING, PRINTING
Quality Castings & Aluminum Products	METAL CASTING
Raytheon Corporation	AEROSPACE AND DEFENSE
Roche Diagnostics Operations	PHARMACEUTICALS
RockTenn - Harrison	PACKAGING, CONTAINERS
Saint-Gobain	BUILDING MATERIALS, GLASS
Schneider Electric	ELECTRIC EQUIPMENT
Serious Materials	BUILDING MATERIALS, GLASS
Shaw Industries	TEXTILE
Sherwin-Williams	CHEMICALS

COMPANY NAME	INDUSTRY TYPE
Solberg Manufacturing, Inc.	INDUSTRIAL EQUIPMENT
Solutia	CHEMICALS, GLASS
Sony DADC	ELECTRICAL EQUIPMENT / COMPONENT MANUFACTURING
Spirax Sarco, Inc.	INDUSTRIAL EQUIPMENT
Steelcase, Inc.	OFFICE EQUIPMENT, FURNISHINGS
Sunoptics Prismatic Skylights	BUILDING MATERIALS, GLASS
TE Connectivity	ELECTRICAL EQUIPMENT
Textron, Inc.	DIVERSIFIED HOLDING COMPANY
The Buck Company	METALS
The Shredder Company	METAL CASTING
The Step2 Company	TOY MANUFACTURING
Thilmany Papers	FOREST & PAPER PRODUCTS
ThyssenKrupp Waupaca	METAL CASTING
Toyota Motor Engineering and Manufacturing North America	MOTOR VEHICLES & PARTS
TRACO	BUILDING MATERIALS, GLASS
United Technologies Corporation	AEROSPACE AND DEFENSE
Verso Paper Corp.	FOREST & PAPER PRODUCTS
Volvo Trucks, Inc.	MOTOR VEHICLES & PARTS
Weyerhaeuser NR Company	FOREST & PAPER PRODUCTS
Whirlpool Corporation	APPLIANCES
World Kitchen, LLC	HOME EQUIPMENT, FURNISHINGS

THE SYSTEM ASSESSMENT

Will the Stand-by Air Compressors Start-Up During Cold Weather?

BY GARY WAMSLEY, JOGAR ENERGY SERVICES

During an energy audit of a facility in the upper midwest, we were asked to investigate an air compressor failure and a brief plant production curtailment issue that ended-up requiring a little of our ingenuity to resolve.

Introduction

The plant operating schedule was normally two shifts of production six days per week. They also conducted process cleaning and maintenance work on third shift and Sundays. Air compressor issues were the least of their utility systems challenges. Lighting, HVAC, and the Boilers were our main objectives, which resulted in several new opportunities for Energy/Sustainability improvements. However, the Engineering Leader had also asked us to investigate the recent compressed air system incident that they were not yet able to unravel.

The facility had two compressor rooms on opposite sides of the manufacturing building, each with two 50 horsepower air-cooled rotary screw units that were fairly new and generally in good condition. Normally one unit ran in each mechanical room and the second unit was in 'auto' stand-by as emergency back-up. Compressor controls were working well and system-wide pressure was within our normal guidelines. Monthly the units were switched from 'lead-lag' for long-term equipment reliability. Hey, a fairly good air compressor system design and operating protocol was in place!

Incident Description

Several days prior to our visit, during a cold winter evening, the lead air compressor in one mechanical room tripped off (apparently due to a fouled intake filter and low air flow through the machine). A crucial situation then developed: The 'stand-by' unit did not start. Maintenance folks had to be called in to get a compressor running. That delay caused low plant air pressure, production curtailment and some defective product. They had yet to determine the conditions that caused the 'no-start'.

Our first order of business was a physical assessment of the equipment. This particular mechanical room (where the incident occurred) was on the ground floor level directly below a boiler room that contained three - 100 hp gas fired, package boilers producing 70 psig steam for product sterilization and for autoclaves to clean material-handling fixtures and holders.

A heat recovery system had been part of a recent utilities energy improvement project. Exhaust air from the first-floor compressor room was being diverted up into the boiler room for warm make-up air during the winter season. KUDOS! This project is a 'double-edged' sword for energy savings. Every 40 °F increase in combustion air temperature to a boiler increases fuel efficiency by 1.0%. The 180 °F exhaust air from the compressor was providing about 125,000 Btuh of 'free" warm air into the boiler room. Moreover, the compressors had 'outside' air intake directly to their enclosures. For compressors, every 10 °F reduction of intake air temperature reduces motor power consumption by 1.0%. During wintertime, compressors are more efficient with outdoor air.

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Compressed Air Best Practices® is a technical magazine dedicated to discovering **Energy Savings** and **Productivity Improvement Opportunities** in compressed air systems for specific **Focus Industries**. Each edition outlines "Best Practices" for compressed air users — particularly those involved in **managing energy costs in multi-factory organizations**.

Utility and energy engineers, utility providers and compressed air auditors share techniques on how to audit the "demand side" of a system — including the **Pneumatic Circuits** on machines. This application knowledge allows the magazine to recommend "**Best Practices**" for the "supply side" of the system. For this reason, we feature **air compressor, air treatment, measurement and management, pneumatics, blower and vacuum** technologies as they relate to the requirements of the monthly **Focus Industry**.

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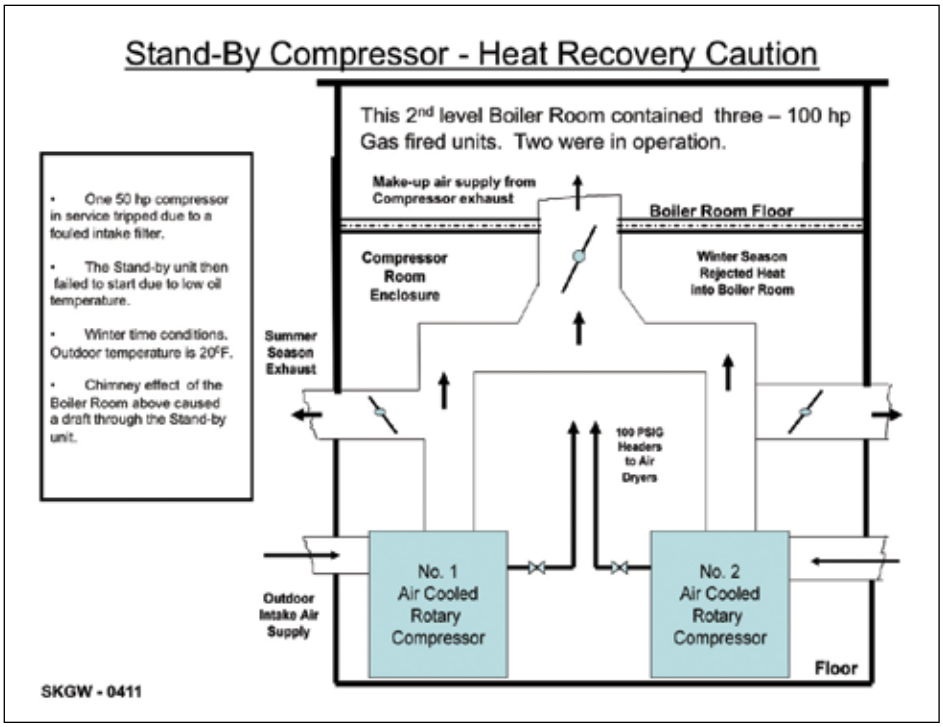
THE SYSTEM ASSESSMENT

Will the Stand-by Air Compressors Start-Up During Cold Weather?

Fresh air supply ducts for each unit extended about five feet to the adjacent outside wall. The exhaust heat recovery ducts were combined into a single larger duct that went up through the floor of the boiler room above. In summer, the hot air from the compressors could be diverted outside. There are three motor–operated exhaust air dampers connected to the 'micro-processor' control system for the compressors. One damper at each compressor exhausts the hot air outdoors for summer mode. The third (isolation) damper was in the common duct going to the Boiler Room. We asked the maintenance guys to manually actuate the dampers as part of our review. This equipment was fairly new and appeared to be in good operating condition. All of the dampers opened and sealed tight at closure. They were apparently not the problem.



Continued Investigation

Later discussion with the 3rd shift maintenance attendant revealed that the 'stand-by' compressor may have failed to start due to 'low oil temperature'. How could this be, since the compressor room walls were well insulated and the room ambient temperature was above 60 °F? Air supply to the operating compressor was ducted in from outside and the ducts were all insulated. Warm air piping, the receiver and the air dryer were heating the room.

We scrutinized the ductwork for the compressor heat recovery system that had been installed as part of the energy recovery job. Discharge air from each compressor cabinet went up to a common T-shaped plenum (four feet square) then up into the boiler room. That common duct contained the diversion damper for summer mode operation. The summer exhaust ducts to outdoors for the compressors were connected just above each compressor housing outlet opening (and before the combined plenum section). Refer to the schematic pictorial layout.

THE SYSTEM ASSESSMENT

Will the Stand-by Air Compressors Start-Up During Cold Weather?

Problem Identification

Alas! A cause for the compressor 'failure to start' was developed using a rudimentary 'problem-analysis' exercise. Warm air from the operating compressor was possibly creating a slight 'chimney' effect in the heat recovery duct to the boiler room (which was also warm and in a negative draft condition). The operating compressor also had fouled intake filters which resulted in less air flow through the machine at the time of the incident. There may have been some 'icing' condition on the filters due to a cold, humid air supply, which can happen on occasion. Since the 'stand-by' compressor did **not** include an isolation damper in the supply air duct, cold 'outside' air was being pulled through the compressor housing and up into the boiler room through the large (two compressor sized) common heat recovery duct.

With a 20 ˚F outdoor ambient and two boilers in operation, the stand-by compressor could be very cold (inside the cabinet). Opening the cabinet doors quickly confirmed our suspicion about cold air being pulled through either unit when in the 'stand-by' mode. It was then that the maintenance technician said that he had wondered why the water drain trap on the 'stand-by' unit was frequently frozen-up. He had not shared the observation. We checked: Sure enough! That confirmed our theory.

Solution

There were a couple of solutions to the condition.

1. Install a temperature controlled heating system on each compressor for wintertime use while in 'stand-by' mode. This option would require design modifications by the compressor service company and would also use some energy. Heat tracing of the drain trap would also be needed. Yet, this would not eliminate the cold air infiltration 'draft' condition.

There simply is no better method for control system designers to 'cover all of the bases' when making equipment modifications than by conducting a thorough 'what-if' risk-analysis investigation and discussing the project with engineers who have extensive field experience.

2. Install electric motor driven isolation dampers in the supply air duct for each compressor. This option introduces additional air-intake suction pressure loss conditions for the compressors if not sized to compensate. Since the compressors were not being operated at near full load, that appeared to be a more practical and less expensive option. Plant Utilities later chose this solution.

Lessons Learned

If your plant air compressor system has automatic start capability for stand-by units (whether centrifugal or rotary), you may want to conduct a 'sanity check' of the emergency start control sequence devices and installation hardware for wintertime operation. Is there a similar set of conditions waiting to happen to your system?

This was the first of three facilities at which we have encountered a 'low-oil temperature' situation on stand-by equipment. The other two were at plants where the compressors were outdoors (under a sheet metal canopy). A cold winter night had caused freezing conditions inside the cabinet of the 'stand-by' unit, even though it had an oil heating circuit for cold 'start-up'. Again, the heat recovery unit (with the exhaust duct going into the adjacent manufacturing bay) was creating a cold air draft through the stand-by unit. One plant had two 300 horsepower rotary screw units; the other had two 150 horsepower rotary screw units. This scenario is not unique to any specific compressor model or vendor. Some newer compressor installations include a 'no-start' condition in the control sequence logic if ambient inside the cabinet is below 28 °F. Hopefully a 'light' will alert you to that condition.

There simply is no better method for control system designers to 'cover all of the bases' when making equipment modifications than by conducting a thorough 'what-if' risk-analysis investigation and discussing the project with engineers who have extensive field experience. BP

For more information contact Gary Wamsley, PE, CEM, JoGar Energy Services, tel: 770-343-9757, www.jogarenergy.com

THE TECHNOLOGY PROVIDER

Double-acting Reciprocating Air Compressors for P.E.T. Bottle Blowing

BY DONALD J. OITKER

P.E.T. Stretch Blow Molding

In the 1970's, the beverage industry began using P.E.T. (Polyethylene Terephthalate) 2 liter plastic bottles primarily for carbonated soda. The most prevalent bottle-blowing machine in use today is the stretch blow-molding machine. A preform plug is inserted into the blow-molding machine, heated, and then compressed air is injected, "blowing" into the preform to create the bottle. These machines can produce from 1,100 bottles per hour to 13,000 bottles per hour, depending on the volume the user requires.

Gardner Denver Bellis & Morcom Compressor for P.E.T. Bottle Blowing Applications

Double-acting, Oil-free, Water-cooled, Reciprocating Air Compressors

Most P.E.T. bottle-blowing machines require anywhere from 550 psig (38 barg) to 580 psig (40 barg) and an air flow of 247 cfm FAD (420 m^3/hr) to 3700 cfm FAD (6290 m^3/hr). The air compressor technology used most prevalently for this application is the double-acting, oil-free, water-cooled, reciprocating air compressor. With the higher pressures and air flows that are required, the P.E.T. bottle blowing market is a strong niche market for the double-acting oil-free reciprocating (piston) compressors. These compressors are heavy duty, long lasting and highly efficient. A double-acting piston air compressor compresses air on both the up and down stroke of the piston and they are available in multi-stages to provide the higher pressures and air flows required for P.E.T. bottle blowing.

These air compressors are available as oil-free. This means that no oil is injected or enters the air compressor cylinder from the crankcase of the compressor. The oil is kept in the crankcase and the cylinder is separated from the crankcase by a distance piece with

The water-cooled motor provides more usable horsepower with less energy. The increase in efficiency is about 2.5% depending on motor size and shaft power requirements.

packing to prevent oil from travelling up the piston rod. The air compressor does not add any oil to the air, which reduces the amount of oil that is passed downstream of the compressor. These oil-free compressors do not add any oil or hydrocarbons to the air that is being compressed — extending the life of coalescing air filters used downstream of the air compressor.

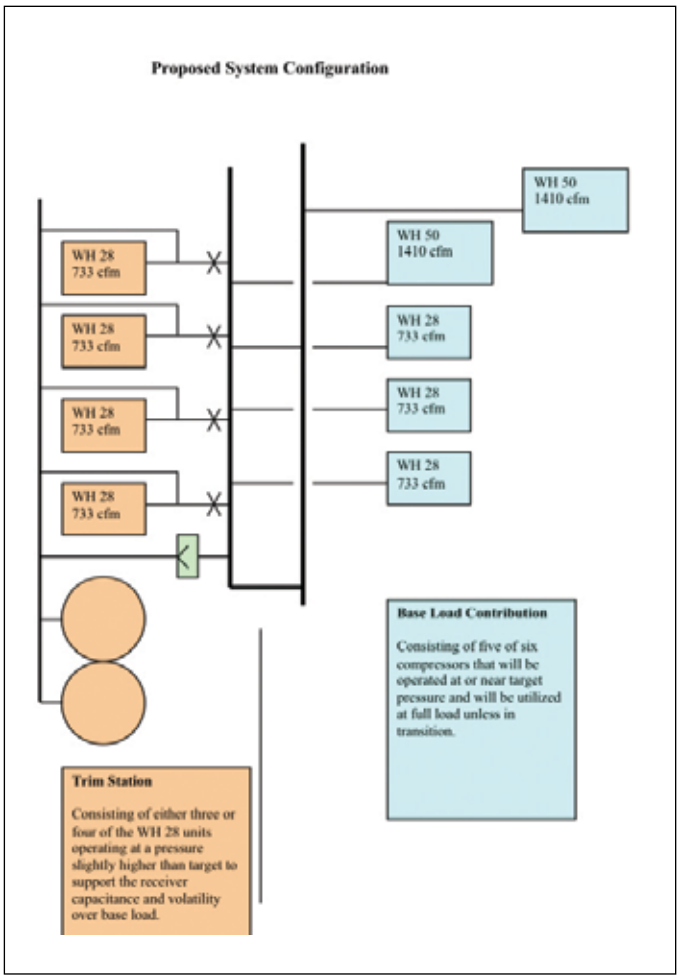
Another new development is the availability of water-cooled motors. The water-cooled motor is more efficient than air-cooled motors and reduces the radiated heat from the motor to the atmosphere. This keeps the compressor room temperature down. The water-cooled motor provides more usable horsepower with less energy. The increase in efficiency is about 2.5% depending on motor size and shaft power requirements. Since the compressor is water-cooled, the small additional requirement for motor cooling is negligible. The reduction in energy cost to produce usable horsepower more than offsets the additional costs for the cooling water. With the elimination of cooling fan noise, the sound level for the water-cooled motor is typically 70 db(A) — a significant reduction when compared to air-cooled motors. To-date the water-cooled motor is used more in Europe but is beginning to be considered and implemented here in the U.S.

Gardner Denver's Bellis & Morcom Air Compressors

Gardner Denver's Belliss & Morcom double-acting, oil-free, high pressure, air compressors are a natural fit for P.E.T. bottle blowing applications. Mike Bakalyar, Manager

THE TECHNOLOGY PROVIDER

Double-acting Reciprocating Air Compressors for P.E.T. Bottle Blowing



Example of a Compressor System Design for a P.E.T. Application

Enhanced Services at Gardner Denver, said, "Belliss has a prominent market position with a market sweet spot of 200 to 400 hp (150 to 299 kW)". Gardner Denver sells direct to the P.E.T. bottle blower and Mike continued, "This is a perfect vertical market application for Belliss & Morcom products."

The Belliss & Morcom compressors are manufactured in the United Kingdom and they come in 50 Hz or 60 Hz electrics. Mike Bakalyar clarified, "For U.S. customers, the compressor is brought in and either sent to the customer directly, or is packaged to meet specific customer requirements". Packaging can include unitizing ancillary equipment such as control receivers, dryers, filters, and control panels — or any other additions to the base compressor.

The air compressors are typically direct-driven using a flange mounted motor with the rotor attached to the crankshaft. They may also be supplied as v-belt driven if this is a customer requirement. Mike Bakalyar said, "Gardner Denver utilizes a systemic approach when working with a P.E.T. customer and user and shows the customer the total life cycle cost and based on that a decision is made on which Belliss & Morcom model should be used." Because the Belliss & Morcom compressors are in a "V" design and are balanced, there is no extra mounting cost required. The plant floor just needs to be able to handle the total static weight of the compressor system.

The Systemic Approach to Designing a System

The large P.E.T. bottle manufacturers have been consolidating over the past few years, and users of PET containers are placing bottle blowing lines in their filling or processing plants. These moves are creating new compressed air system designs. Mike Bakalyar commented, "We are working with many customers who have been users of P.E.T. containers for years but are new to the blow molding processes. Gardner Denver has the capabilities to guide these customers towards best practices in compressor selection, control strategy, and system interface – all of which influence total cost of ownership".

Collecting data on operational performance helps to peel the onion and expose waste in both supply and demand segments of the system.

"We work with the customer to ensure there is a clear understanding of how system design choices will influence total life-cycle costs. It is our objective to help the customer avoid unintentional cost leakage in the support of their manufacturing processes."

— Mike Bakalyar, Manager Enhanced Services at Gardner Denver

There are many cases when applied conventional wisdom can have very costly long term consequences. Bakalyar said, "We work with the customer to ensure there is a clear understanding of how system design choices will influence total life-cycle costs. It is our objective to help the customer avoid unintentional cost leakage in the support of their manufacturing processes."

A systemic approach to designing a system, can include taking a look at what the air demand is and whether it is a constant demand or cyclical one and how many compressors the customer currently has. Depending on how much air demand is going to be added or perhaps subtracted, a determination will be made if it will be better to add compressors or to go to one large compressor. A total operating cost analysis, with all the proposed compressors and ancillary equipment, will then be performed. Routine maintenance costs are included based upon the recommended maintenance intervals. Even though a large horsepower double-acting compressor can run effectively and efficiently at part load, it might be better to have more than one compressor so that you have built in a back-up compressor for maintenance periods and in the event a compressor is down for repair. Therefore, when you have more than one compressor with controls that will bring on each compressor as needed by the air demand, this is sometimes is more cost effective than having one large compressor that runs with a part load requirement. The systemic approach works with the user to determine which scenario will provide the user with the most effective and cost efficient system.

A double-acting piston air compressor compresses air on both the up and down stroke of the piston and is available in multi-stages to provide the higher pressures and air flows required for P.E.T. bottle blowing.

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Double-acting Reciprocating Air Compressors for P.E.T. Bottle Blowing

Compressor Controls for Energy Efficiency

As the price of electricity and water increases, P.E.T. bottle blowing manufacturers are becoming increasingly of the energy costs of their compressed air systems. Bellis & Morcom air compressors have compressor controls designed to operate the compressor in the most efficient mode possible. There are three main control systems: 1) Step Loading, 2) Variable speed and 3) Air Recovery.

Step Loading Control

The Step Loading Control will hold the suction unloading valves (SUV) open so that no air is brought into the compressor and no compression or pressurization of the air is taking place. The compressor is still running but no air pressure is developed. In this mode the compressor is operating at 8–10% of Full Load Brake Horsepower. So, if you have a compressor that requires 210 brake horsepower at full load, when you are in this mode your brake horsepower will drop to 16.8 to 21 brake horsepower. Mike Bakalyar said, "Because unloading is nearly instant, the power curve is essentially straight between full load and the unload point. Since this basic standard control is very efficient the improvement provided by the following enhanced controls needs to be carefully considered and properly applied to gain meaningful operating savings."

Variable Speed Control

With the variable speed controller, you have to be careful not to slow the compressor down below the minimum speed that will affect the lubrication in the bottom end. The variable speed controller can lower your speed to 50–60% of full speed, keeping power consumption linear to the demand being supported. Variable speed control also lowers operating unloaded brake horsepower to 4–5% of full load brake horsepower. For our 210 full load brake horsepower example, this reduces your unloaded power to 8.4 to 10.5 brake horsepower. This again is a dramatic drop in electrical costs. Variable speed control is most effective when applied in a single compressor application or assigned to a designated trim compressor in a multiple compressor system.

Recovery Mode Control

The Recovery mode controller allows users to use some of the "blow-by" air. Since the air used to blow the bottle material into the mold at high pressure is vented at the end of the cycle, it is possible with some mold designs to capture a portion of this vented air. The air recovery mode control will capture this air and feed it back to the compressor. In this mode the recovered air is introduced at the second stage of the compressor eliminating the power associated with compression in the first stage. The compressor in this control mode is performing the role of a booster since the first stage work is recovered from the process. The benefit here is that you have spent energy and money to get the air to 550 psig and by the time it comes back to the 2nd stage it is at around 150 psig, it will take less work (and money) to increase the pressure back to the desired 550 psig.

Another option for some P.E.T. bottle blowing users is to capture the "blow-by" air from the process and feed it into their plant air system which will lessen and sometimes eliminate the need for their plant air compressor to operate — except in peak plant air demand periods.

"We approach applications from a systemic view and design to consider issues such as load cycles, operating base load assets at demand target pressures, utilizing design capacitance, and other factors that work together to influence total system costs."

— Mike Bakalyar, Manager Enhanced Services at Gardner Denver

Control Automation

Control automation and system management options can ensure that multiple compressor installations are operated at best practice efficiency. System design configuration and associated control strategy is designed to utilize the best combination of the above control options to deliver the lowest possible energy consumption at all levels of demand and to ensure component reliability. Mike Bakalyar indicated, "We approach applications from a systemic view and design to consider issues such as load cycles, operating base load assets at demand target pressures, utilizing design capacitance, and other factors that work together to influence total system costs."

Conclusion

Double-acting, water-cooled, oil-free reciprocating air compressor systems provide the P.E.T. bottle blowing industry with the pressure, air flow and cost effective controls required to operate the energy-efficient and reliable systems. Despite the changes in the manufacturing landscape, one thing that remains clear is that with all the bottled water and carbonated sodas being consumed worldwide, the P.E.T. bottle blowing market will be around for some time to come, and with it the double-acting, water-cooled, oil-free reciprocating, air compressors. BP

For more information please contact Compressed Air Best Practices at www.airbestpractices.com or Gardner Denver Bellis & Morcom at www.gardnerdenverproducts.com

THE ENERGY MANAGER

Energy Management at Visteon

BY ROD SMITH, COMPRESSED AIR BEST PRACTICES® MAGAZINE

Compressed Air Best Practices® Magazine interviewed Jennifer Meier, Global Energy & Engineering Manager, at Visteon Corporation.

Good morning! Please describe Visteon and the products manufactured.

Good morning. Visteon Corporation is a leading global automotive supplier that designs, engineers and manufactures innovative climate, interior, electronic and lighting products for vehicle manufacturers. Visteon revenue in 2010 was $7.4 billion and the company was ranked 335 in the Fortune 500. Corporate offices are located in Van Buren Township, Mich. (U.S.), Shanghai, China; and Chelmsford, UK. Visteon has facilities in 26 countries and employs approximately 26,500 people.

Installing fresh air ducting improves positive pressure in plant and off-sets heating requirements

Reducing energy costs is a corporate initiative that is reviewed by senior leadership every two months with respect to the status of energy performance and current projects.

Please describe climate products and the main manufacturing processes required to produce them?

There are three main segments in Visteon's climate group are climate systems, powertrain cooling and engine induction. Climate systems include refrigeration compressors, fluid transport, heat exchangers, battery cooling modules, climate controls, auto defog/demist systems, and multi-zone HVAC systems. Powertrain cooling systems include heat exchangers (radiators, condensers, charge-air, exhaust-gas), airflow management, and diesel and hybrid thermal management. Engine induction includes air induction systems and intake manifolds.

One of the more energy intensive processes in our plants supports our climate business due to the presence of special-atmosphere furnaces in some of the plants. The main manufacturing processes include furnaces, brazing, significant metalworking, AC line crimping, metal-working and some injection molding for the HVAC cases for the evaporator, and heater cores in a HVAC SYSTEM.

Please describe the other product groups and the main manufacturing processes required to produce them?

The two main segments in interiors are cockpit modules, which includes instrument panels and floor consoles, and door trim. Injection molding processes are the biggest energy users in this product segment.

Electronic products include all the audio, climate and driver information in a car. We manufacture the audio and "infotainment" systems, the instrumentation, the displays and the controls panels in a car. The manufacturing systems for these products include conditioned spaces, soldering, circuit assemblies and clean rooms.

Lighting is a segment within electronics that covers a variety of front and rear lighting systems and lamps. Manufacturing processes in this segment include injection molding and large assembly areas.

What does Visteon focus on in terms of energy-spend and describe the team manages it?

Visteon's "energy-spend" encompasses all energy sources including usage of natural gas, electricity, propane and diesel fuel. Reducing energy costs is a corporate initiative that is reviewed by senior leadership every two

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THE ENERGY MANAGER

Energy Management at Visteon

months with respect to the status of energy performance and current projects. This is a very active program and has given energy management the required focus in our manufacturing plants.

The energy optimization efforts fall within the purview of global environmental, health and safety (EH&S). I am responsible for leading the overall initiative and implementing energy optimization programs throughout the company; I have two regional full-time engineers also working in this area. We are a very lean organization and must prioritize which projects have the greatest influence on reducing energy costs. The current project hurdle rate is a 12-month payback or less.

Please describe how monitoring is a big factor in Visteon's energy management strategy.

One of Visteon's main focuses is the use of interval data – both the total plant profile and from individual pieces of equipment. Our goal is for every plant to have a method to monitor total plant power as a demand profile. Typically, this data is available from a utility provider website or a simple building monitoring system.

We also ensure each plant understands their tariff structure, which is a critical to understand what is charged throughout the day, as well as during peak and non-peak hours. One very successful project involved moving a batch process to a lower-tariff time period. In this example there was no impact on production and required no capital investment – just a change in scheduling that yielded a significant cost save.

To further understand the electricity use, low cost data loggers are placed on energy-consuming equipment that maps the data against productivity data – such as parts produced or direct labor – to better understand what the data is telling us.

Another example is regular monitoring of interval data on air compressors used in plants. We want see if the air compressors in the plant are loading and unloading properly. We use this data to determine what actions can be taken to reduce energy costs, such as taking an air compressor off-line completely. We look at how to reduce the demand for compressed air and investigate whether an equipment upgrade is necessary – like to a variable frequency drive (VFD) compressor or to a smaller point-of-use air compressor.

Furnace make-up air is supplied directly from outside to improve pressure balance and reduce heating requirements

THE ENERGY MANAGER

Energy Management at Visteon

Venturi nozzles installed on open blow-offs reduce compressed air usage

Electric blower replaces compressed air use in headlamp production

Toolroom lighting upgrades: older metal halide lights shown on right, newer high-efficiency T5 fluorescent lights on left

Describe how Visteon focuses on low-cost projects to reduce energy cost.

Typically, actions can be taken that reduce energy with little to no capital expenditures. For example, lighting levels can be optimized before considering a retrofit. The team will tour a facility and conduct an audit. We then look for areas where unnecessary lighting exists – like in partially unoccupied spaces with infrequent occupancy. Sensors may be installed to keep the lights off. We also focus on areas where overhead and task lighting is used and evaluate whether both are needed. Once a project is initiated for a retrofit – say from metal halide lights to high efficiency fluorescent – the return on investment is typically less than a year depending on the plant's operating hours and electricity tariff.

Data loggers are used to help analyze when to start-up equipment. Ovens have data loggers equipped to determine the length of time it takes for the oven to reach operating temperature. Traditionally, ovens took seven hours (to get to temperature); now, they can reach temperature in just three hours.

Shutdown optimization is another area of opportunity as shifts and orders are always changing, as is overall plant demand. Visteon manufactures parts very close to order levels. The 2009 decline in production demand was a real test of Visteon's energy program with significant reductions in order levels, the plants that were able to reduce energy costs significantly fared better during this time. Air compressors, HVAC, cooling water loops – these are not fixed costs; and the energy program has to be able to reduce energy costs when production demand goes down.

Another high priority at Visteon is to eliminate supplemental heating in manufacturing spaces. Anywhere there is waste heat, we look to harness that energy source. We work to use waste heat from air compressors and from injection molding machines.

How did energy management get started at Visteon?

Energy optimization has always been a focus at Visteon; however, the initiatives were fragmented and managed locally at the facility level. In 2005, EH&S formalized the group and began initiating projects to better understand opportunities across our operations.

Another high priority at Visteon is to eliminate supplemental heating in manufacturing spaces. Anywhere there is waste heat, we look to harness that energy source.

It was then that the team established best practices for the following processes:

1. Heat Recovery
2. HVAC
3. Lighting
4. Shutdown Optimization
5. Demand Control
6. Compressed Air

Global webinars with the plant engineers were conducted to review the fundamental concepts and goals. Regional workshops taught best practices in each process to train engineers on the use of the data loggers. This training was focused primarily in Europe and North America. Now, the team is training plants and joint venture partners in Asia.

Once projects were identified, it became important to track progress and measure the data. An internal system was developed that allowed plants to enter project data and classify it into one of the six best practice "buckets." Getting that accurate and timely data can be a struggle – particularly shutdown optimization data, which doesn't require new equipment or capital, but is behavior-based.

What metrics are used to measure energy performance?

The main metric is energy efficiency, which is total energy used divided by value-add. Value-add is measured by revenue minus material costs. The value-add component is intended to be the productivity level of the facility – that is, what this facility does to product that part.

Chemical tanks requiring airlock – reduces compressed air use during lower production periods by installing small dedicated compressor

We also conduct year-over-year comparisons and our target for 2011 is to improve this metric by 10%. This metric is measured at the plant level and by product group, and then we can roll it up at the corporate level. An energy-use dashboard is accessible to every employee to view the data at any time.

THE ENERGY MANAGER

Energy Management at Visteon

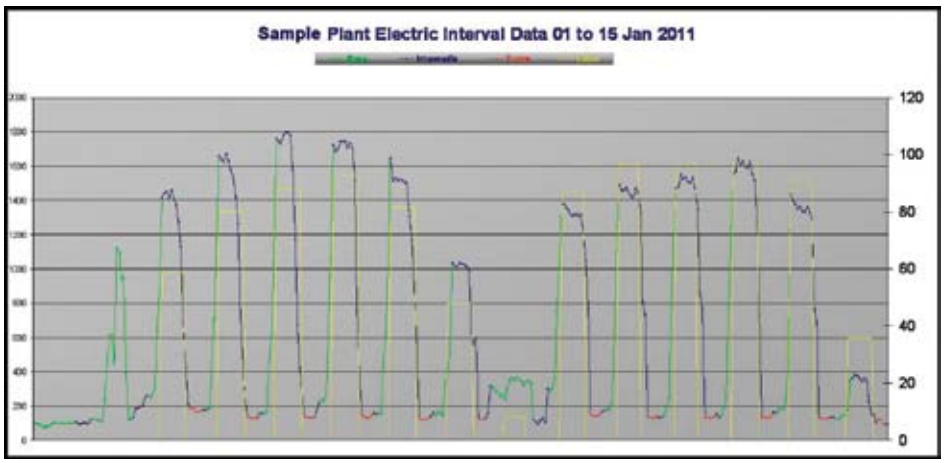
Small dedicated compressors are used for chemical tanks

Last year, a plant recognition – called the "Visteon Green Plant" designation – was initiated that uses many of these aspects in the determination, including energy efficiency.

How is compressed air managed at Visteon?

Visteon treats compressed air as a high-cost utility and challenges manufacturing to identify ways to optimize the system, with the basic premise in understanding how the company manages compressors as it relates to production levels. In one example, we found through the interval data a compressor was running during an off-shift at a local facility. Leak audits were conducted and some open valves were closed, but a compressed air demand during an off-shift was still occurring. It was determined an airlock on a chemical tank caused a 100-horsepower air compressor to keep turning on. As a result, a smaller, dedicated air compressor was installed to handle the process and enabled the 100-horsepower air compressor to be disabled.

Another focus of the team is to identify opportunities to use blowers versus compressed air. Blow-off air is used, for example, in the headlamp production process. Through investigation, we found that energy costs associated with blow-off are reduced and quality of the process is improved when an electric blower is used compared to compressed air.



Electrical demand (kW) plotted versus direct labor showing correlation between energy use and production activity

Besides reducing energy costs, what are some other realized benefits from energy management at Visteon?

An important reason energy management is a priority at Visteon is that it not only helps the environment, but also has positive implications on quality improvements. Energy management projects can also improve plant hygiene and work environments.

The team has placed emphasis on reducing heat costs in colder locations by reducing the negative pressure in the plant. This is accomplished by bringing in cold, fresh air from the outside, high in the ceiling. The cold air mixes with the rising waste heat above the manufacturing processes and gently falls downward to warm the plant. In addition, we have projects that route supply air to the outside, instead of using inside air that creates a negative environment. By off-setting negative pressure in the plant, local exhaust for fumes from processes can operate more effectively improving the overall air quality. It also reduces drafts coming in at floor level, providing an improved working environment. We have had facilities verify significant savings from these actions. BP

For more information on this article please contact Rod Smith, Compressed Air Best Practices Magazine, email: rod@airbestpractices.com, tel: 412-980-9901, www.airbestpractices.com or visit www.visteon.com

COMPRESSED AIR EFFICIENCY OPPORTUNITIES IN THE PLASTICS INDUSTRY

BY DEAN E. SMITH, IZ SYSTEMS, FOR THE COMPRESSED AIR CHALLENGE® CAC QUALIFIED LEVEL 2 INSTRUCTOR

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As in most industrial categories, compressed air is critical to the operations of a plastics plant whether it is blow molding, injection molding, or other processes. The opportunities to improve supply side (compressor room) efficiency are similar to all industrial compressed air systems, but are even more prevalent in some plastics facilities, especially blow molding. On both the end use and production side of the air system, the plastics industry offers some unique constraints as well as significant efficiency opportunities not found in other industries. In this article, we will explore these efficiency opportunities and attempt to understand why they exist and how we may begin to capture them.

In our work, auditing and designing solutions in the process areas, we insist on measuring and recording the actual flow and pressure inside the production equipment with high speed data loggers so that we can see the actual performance of the compressed air. This provides the opportunity

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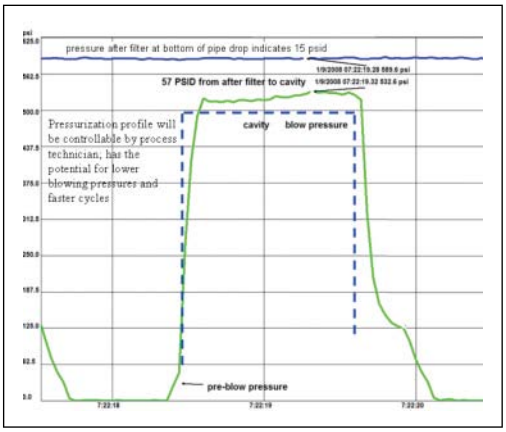
COMPRESSED AIR EFFICIENCY OPPORTUNITIES IN THE PLASTICS INDUSTRY

to identify any areas where compressed air problems are creating productivity and/or quality limitations, the improvement of which might lead to lower energy costs and/or increased production rates. Blow molding process analysis offers some of the most striking examples of the opportunities that exist. We will examine one example of the blow molding process in detail, but be aware that most of the opportunities described exist in all high volume, short duration processes at some level.

A blow machine running 16 oz. bottles at 24,000 bottles per hour can consume 2,800 to 3,200 scfm depending upon process setup which creates significant pressure drop in the headers and filters delivering the air to the blow machine.



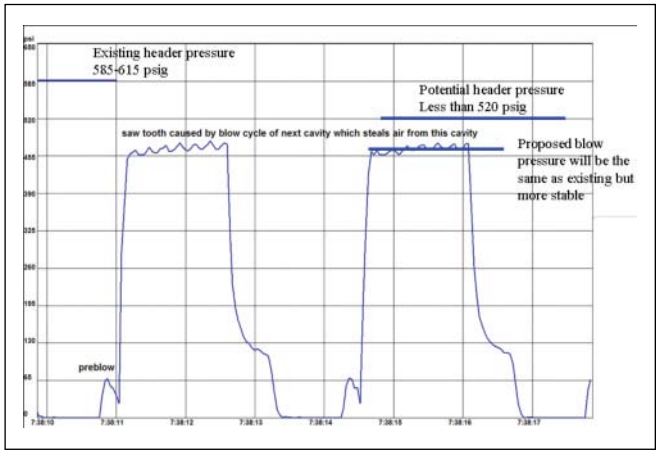
Blow molding example of opportunities

There are a variety of blow molding processes and all of them require stable compressed air pressure delivered to the molding machine to control quality and maintain productivity. In most blow molding processes, compressed air is used to inflate the parison or "preform". The parison is a tube-like piece of plastic with a hole in one end through which compressed air can pass. The compressed air also cools the part after inflation to final form, but prior to ejection from the mold.

In PET bottle blowing, high speed rotary machines use 600 psig compressed air to produce bottles at rates greater than 20,000 bottles per hour. In analyzing these systems it is quite difficult to record the actual cavity pressure at high enough resolution to properly map this process, but that is what is required to see the real opportunity. Graph #1 shows the typical pressure map of cavity pressure in blow molding recorded at 0.04 milliseconds sample rate. The green line shows the actual cavity pressure which blows the bottle into the shape of the female mold. The blue dashed line shows the desired pressure. Note that the actual rate of rise does not provide a straight line to terminal pressure because it is a function of the flow capability of the components delivering the air to the cavity. In other words, the blow solenoid, the air hose internal to the machine, and the stretch rod which delivers the air into the parison have a limited flow capability which prevents the immediate rise to terminal pressure. This means the rate of pressure rise becomes dependent upon the pressure differential driving the flow from the air inlet of the machine to the cavity. Obviously, the higher the inlet pressure the faster the rate of pressure rise, so a common way of managing the compressed air system in a blow molding facility is to increase system pressure to maximize productivity and still produce good product. Unfortunately, higher pressure leads to wasteful artificial demand, elevated compressor energy and maintenance costs, and inefficiency in managing the system.

The real costs of higher system pressure

The Compressed Air Challenge (CAC) has published considerable information on the energy costs of higher compressed air system pressure, but a few items bear reviewing in terms of our blow molding example. For example, the desire to inflate the parison, or blow the part, as quickly as possible leads to very high rates of flow in supply components which creates high pressure drop. A blow machine running 16 oz. bottles at 24,000 bottles per hour can consume 2,800 to 3,200 scfm depending upon process setup which creates significant pressure drop in the headers and filters delivering the air to the blow machine. We have measured pressure drops from 50 psid to as high as 110 psid (see Graph #2). In order to make acceptable bottles with this level of pressure drop the system has to operate at dramatically higher than necessary pressure.



Artificial Demand

This higher than necessary pressure means in this example each bottle requires 8.0 standard cubic feet (scf) of air at a terminal pressure of 530 psig. Because the header pressure is elevated to increase the inflation pressure differential, the blow pressure continues to rise to higher than required pressure after the bottle is fully molded (see Figure 1). For every bar or atmosphere (14.5 psi) of pressure increase above the required blow pressure, the volumetric flow required increases by the volume of the bottle. For example, one bar in excess pressure for a 16 oz. bottle times the production rate (24,000 BPH) equates to 50 scfm in artificial demand. In this particular study, which had pressure drops from 50–110 psid, the opportunity is 170 to 370 scfm reduction in compressed air demand.

Although compressed air storage tanks are expensive, the lack of appropriate storage is even more costly if it makes it necessary for additional compressors to run part loaded to deal with the rates of pressure change which occur.

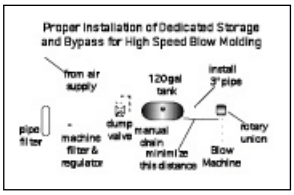
COMPRESSED AIR EFFICIENCY OPPORTUNITIES IN THE PLASTICS INDUSTRY

Higher maintenance and energy costs on the compressors

The most common compressor for achieving these pressures is a 3 stage reciprocating machine which uses valves to control the flow of air through the stages. At these higher pressures the temperatures are much higher, which increases the stress and wear on discharge valves and other critical components. Where it was possible to substantially decrease the discharge pressures, it has been documented that maintenance cycles are extended by as much as 25–30%. Power is also reduced at the lower discharge pressures by a ratio of 1% energy reduction for every 5% pressure reduction. A reduction of 100 psi or 16% will mean about a 3% energy reduction at the compressors.

Capturing the efficiency opportunities

The first step in capturing these efficiency opportunities is to minimize the pressure drop within the molding machines, which normally requires removing and/or replacing pneumatic components with those of higher flow capability. The regulators and filters are critical items in this regard and must be examined closely by measuring the pressure drop while the machine is running and blowing bottles. It can be very difficult to determine the pressure drop with gauges. The use of electronic measuring equipment such as transducers with digital readouts to produce reasonable accuracy is recommended. Localized storage receivers can also help minimize pressure drop by supporting the very high rates of flow during each blow cycle with stored air. This storage must be located as close to the point of consumption as possible; for example, it must be tied into the pneumatic circuit after the filter and regulator to be of any value. Note in the schematic (Figure 3) the storage is located as close as possible to the point of use and that the piping and hoses from the tank to the point of use are as large as possible to support the high instantaneous rate of flow. Working with a professional compressed air consultant is advised for this effort to minimize the costs and maximize the results of the effort.



System management

As previously noted, the rates of air flow to blow molding machines are very high, which inherently creates a very unstable main compressed air system condition when the molding machines start and stop. When 3,000 scfm of air demand suddenly starts or stops, the rate of change of pressure in the main system can be as high as 2.5 psi per second, which is faster than the compressors can react. For example, these high pressure compressors will take 15–30 seconds to load from a stopped condition, so pressure can often drop more than 35 psi before a required machine comes online. Often it takes more than one compressor to satisfy the increased air demand causing the pressure to drop even further. Managing this level of pressure change requires several significant modifications in the approach to system management

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Principal of iZ Systems and original founder of Air Management and Air Science Engineering; 20 years experience as a consultant in compressed air and gas system analysis; conducting complete audits on over 1,000 plant air systems in a variety of industries defining existing and proposed air demand and electrical power requirements. Audits include designing solutions to problem process applications and defining retrofit requirements to provide a return on investment based on the recommended modifications. The practical experience of implementing hundreds of the audited system recommendations has had a dramatic impact on his audit approach and recommendations.

- Member of the Core Technical Group of the Compressed Air Challenge which was responsible for writing the training materials.
- Founding member of the Compressed Air Efficiency Council created by industry consultants to promote more efficient use of compressed air in industry in cooperation with the Compressed Air Challenge program.

in order to maximize efficiency. A dramatic increase in the amount of storage is obviously required, as is the case with most compressed air systems. Although compressed air storage tanks are expensive, the lack of appropriate storage is even more costly if it makes it necessary for additional compressors to run part loaded to deal with the rates of pressure change which occur.

Additionally, an appropriate automation system which calculates the rate of pressure change and makes intelligent decisions regarding the appropriate supply-side response can make a significant difference in energy costs as well as reduce compressor cycling, wear, and motor starts. Avoiding an unnecessary compressor start due to the rate of change, and the associated time required before it can be turned off, can mean tens of thousands of dollars in energy costs per year.

Other plastics operations

While this in-depth example is specific to blow molding, it also applies to many other plastics operations. Injection molding machines which use compressed air for part ejection and cooling have very similar characteristics in many areas. Many of these machines have stated requirements for pressure from 150 to 250 psig, but pressure drops from 50 to 100 psi have been measured in these systems as well. Similar solutions are appropriate for this equipment, meaning pressure drop must be reduced by installing higher flow components and consider adding storage close to the point of consumption of compressed air.

As we have examined in this article, the key steps in maximizing efficiency for compressed air systems in plastics plants is to measure the actual pressure at the point of use and the pressure drop from the main header to that point. Then, minimize the pressure drop by installing higher-flow components and storage where appropriate. Adding storage to the main air system and the use of automation and pressure flow controllers will allow the supply system to appropriately respond and manage the compressors in these highly volatile air systems will then allow you to maximize the efficiency of the system. BP

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The 2011 edition of the AICD was held May 15–17 at the Red Rock Resort in Las Vegas, Nevada. Located a medium distance off the strip, the Red Rock Resort is a unique mix between a high-end resort and a casino. It sports a definite "cool" factor as it hosts rock concerts on a regular basis and is decorated to please this clientele. So, of course, we "compressed air people" fit right in!

Attendance levels, at the Conference, were excellent by both exhibitors and the membership of the association. The AICD President, Manny Cafiero of Scales Industrial Technologies, said, "We are pleased with the strong booth and member turnout as well as with the strong speaker program."

AICD President, Manny Cafiero, visiting with Mike Angotti and Barb Pontisso at the ASCO Numatics booth.

The Conference

The speaker line-up delivered on President Manny Cafiero's promise to be "relevant to all segments of a distributors' business." The first presentation was titled "The Economy and Small Business" presented by Dr. Carol Dole from Jacksonville University. The presentation provided a summary of the current economy, a forecast of things to come, and an overview of which metrics to monitor.

Joseph Lapiana, from New Media Marketing, then presented "Successful Marketing in a New Era." The focus of the presentation was on understanding and capitalizing on electronic media. The use of Social Media, web sites, e-newsletters, and blogs was discussed as effective and low-cost ways to market in today's world.

Paul Fury, from The Fury Group, presented "Customer Relationship Management". He emphasized the importance of organized and accessible customer data for a sales and service company. This ability to know and quantify customer segments may be a key differentiating factor between companies in the future. An emphasis was placed on the fact that the use of cloud-based technology has made CRM more accessible than ever before.

John Hamilton, from Service Strategies, gave a presentation titled, "Field Service Management" and David Haslam, from SGS, gave a talk on "Green Initiatives". Both presentations were very insightful. Mr. Haslam's presentation spoke

Charlie Solberg, Clint Browning, Charlie Pugh, Cheryl Kiker, Bill Kiker, Mike Block, Steve Kollmyer, and Jason Pyle (left to right)

John Briggs, Manu Srivasteiva and Tilo Fruth and J (left to right) discuss BEKO compressed air measurement products.

THE 2011 AICD CONFERENCE & EXHIBITION

Laura Traylor and Ruby Ochoa, (left to right) from Trace Analytics presented their new "AirCheckLab" services.

Lane Hawkinson, from Rogers Machinery, presented the new KOBELCO KNW Series 00 frame for 20-50 hp, two-stage, oil-free, rotary screw air compressors.

to the issues of driving a green program into your business and how you can make not just a positive marketing effect but a real cost savings that can be realized. Now that sounds familiar!

The Exposition

At the exposition, I normally disappear from my booth and don my "roving reporter" hat. I wander around wielding my low-budget digital camera and get into interesting conversations during the exhibition. Here is a summary. My apologies go to the many booths and firms not mentioned due to the space limitations of the article.

SOLBERG has really captured my imagination and admiration because of their entrepreneurial spirit and their commitment to international growth — beginning back in 1992 when Charlie Solberg moved to Germany to "start from scratch". The Company is now a truly international player and healthier for it in terms of breadth of product line, technical and certification capabilities, and a diversified revenue stream. Their marketing team is also darn good as their booth always had a big crowd enjoying the keg beer served in Solberg beer steins! Solberg showcased the STS liquid knockout trap with a see-through container and drain. The STS product protects vacuum systems in harsh environments including meat packing, soil remediation and vacuum sewer applications. Connection sizes are available in 2"–4". More info at www.solbergmfg.com.

A topic I hear more and more interest in from Corporate Energy Managers at large multi-factory corporations is MEASUREMENT.

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Utility and energy engineers, utility providers and compressed air auditors share techniques on how to audit the "demand side" of a system — including the **Pneumatic Circuits** on machines. This application knowledge allows the magazine to recommend "**Best Practices**" for the "supply side" of the system. For this reason, we feature **air compressor, air treatment, measurement and management, pneumatics, blower and vacuum** technologies as they relate to the requirements of the monthly **Focus Industry**.

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Hal Burke announced the inauguration of AIRCOM USA at the AICD. The company manufactures aluminum compressed air piping and mechanical connecting fittings.

Nick Herrig and Denis Williams (left to right) from Parker PDF presented the Parker domnick hunter ThermalStar thermal mass cycling refrigerated air dryer presented in a package with the OIL-X Evolution oil coalescing filter to provide air quality to ISO 8573.1 Class 1.4.1.

The old adage, "You can't manage what you don't measure" has never had a better application than compressed air systems. Sophisticated end users want to know what dollar ($) charge, for the kW's associated with compressed air, should be applied to the paint line. What should be charged to the bag house area….and so on.

BEKO Technologies has made a significant investment in the area of Measurement and Management and their booth continued to reflect this. The MetPoint product lines, according to Beko USA President, Tilo Fruth, are gaining acceptance rapidly as distributors learn to work kW, flow, pressure, and dewpoint measurement into their value propositions to clients. The MetPoint OCV product line goes a step further in providing real measurement of Class Zero oil-free air to 0.03 mg/m^3 oil content. Oil-free air compressor users, concerned with the possible presence of ambient hydrocarbons, are installing the BekoKat system along with the MetPoint OCV to be 100% sure of oil-free air. More info at www.bekousa.com.

A newcomer to the scene, Trace Analytics out of Austin, Texas, presented their capabilities to provide testing services for compressed air quality levels. Their business sends out different air sampling kits and the customer returns the air sample to them for analysis. This appears to be a convenient and low-cost way to monitor compressed air quality in sensitive applications. More info at www.aircheclab.com.

Hankison SPX displayed the HES240 cycling digital-scroll refrigerated air dryer. The cold-coalescing oil filter is integrated into the dryer after the filter/separator — making a very

compact space-saving package. More info at www.hankisonintl.com.

Rogers Machinery Company highlighted their new Kobelco KNW Series 00 frame oil-free compressor. It is the world's only two-stage, oil-free, rotary screw air compressor in the 20-50 horsepower size. The package has been completely redesigned based on feedback from customers in the hospital, laboratory and university markets. More info at www.knw-series.com.

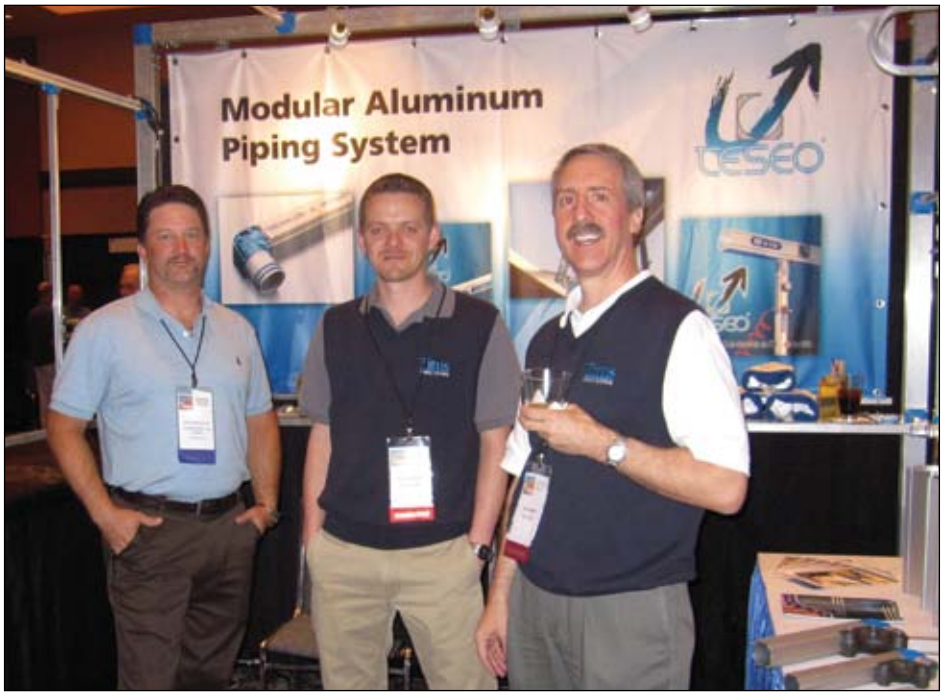
A big announcement was the inauguration of Aircom USA — based out of the Charlotte area in North Carolina. Industry veteran Hal Burke is running the new subsidiary for this Italian manufacturer that has a significant market share in Europe. Ready-to-go with NPT threads or ISO-7 threads, the die-cast aluminum pipe range is between 20-110 mm diameter (20, 25, 40, 63, 80, 110 mm). I found the die-cast aluminum fittings to have a real premium look and feel. They also have a line of "Technopolymer" distribution systems. More info at www.aircom.us.com.

Parker PDF is still the reigning champion with the most entertaining booth (Solberg is getting closer though). The tuxedo-clad dealer taught association members how to play craps (yes, the casino game) and readied a few people (whom I won't mention) for some serious throwing later that evening! Nick Herrig's team also presented the Parker domnick hunter ThermalStar Smart Thermal Mass Cycling Refrigerated Air Dryer package complete with OIL-X EVOLUTION filtration to provide air quality to ISO 8573.1 Class 1.4.1. It's a nice package giving customers the energy-savings of a cycling refrigerated dryer combined with

Jim Bruce, Andy Brinka and Ray Brahm (left to right) at the SPX Hankison booth discussing the HES Series cycling refrigerated dryer with integrated 0.01 micron separator and cold-coalescing 0.01 ppm oil removal filter.

Jonathon Ricker and Bob Whiting (left to right) from Ultrachem displayed their new generation of long-life lubricants for rotary screw compressors.

THE 2011 AICD CONFERENCE & EXHIBITION



Jeff Brennan, Brian Titus and Jim Bower (left to right) review the TESEO line of compressed air piping and fitting products.

Rhett Newberry and Lee Levisay (left to right) from the PRO'S Company displayed their airend rebuilding capabilities.

the air quality provided by a oil-coalescing filter. More info at www.parker.com/pdf

Ultrachem displayed their line of synthetic lubricants for rotary screw air compressors including a new generation of long-life (4-6,000 hours) lubricants. Ultrachem offers food-grade lubricants and private label services for distributors. The company President, Bob Whiting, said that company growth was "significant" this year and was very upbeat. More info at www.ultracheminc.com.

A company that caught my attention was the PROS Company. Based in Lubbock, Texas, this firm rebuilds airends for rotary screw compressors and is growing quickly. They provide a technical evaluation of each airend and only charge for what they do. Customers receive digital photos of the whole process and a one year warranty. This company seems like a real "up and comer".

TESEO displayed their modular aluminum piping systems. Industry veteran Jim Bower demonstrated the aluminum piping, the low-pressure drop fittings and the complete range of drops that makes the TESEO product line unique.

Conclusion

Once again the AICD was a very entertaining and educational event. This was one of the best organized and run distributor conferences I have been to. For anyone wanting more information on the AICD, please contact Cheryl Kiker at aicd@aicd.org or visit www.aicd.org. BP

RESOURCES FOR ENERGY ENGINEERS

TRAINING CALENDAR

TITLE	DATE	LOCATION	SPONSOR(S)
Visit www.compressedairchallenge.org for more information.			
Advanced Management of Compressed Air Systems	July 12–13, 2011	Pocatello, ID	Idaho Power Company, Idaho Office of Energy Resources, Rocky Mountain Power, Washington State University Extension Energy Program, Bonneville Power Administration, Northwest Food Processors Association, Compressed Air Challenge, DOE EERE
Fundamentals of Compressed Air Systems (Level 1)	July 22, 2011	Decatur Utilities – Training auditorium Decatur, AL	Alabama Technology Network, Tennessee Valley Authority, DOE EERE, Compressed Air Challenge
Advanced Management of Compressed Air Systems (Level 2)	August 30–31, 2011	Indianapolis, IN	—
Fundamentals of Compressed Air Systems WE (web-edition)	September 12, 2011	Online Training	—
Fundamentals of Compressed Air Systems	October 11, 2011	Navy Pier – WEEC 2011 Chicago, IL	Association of Energy Engineers, USDOE, Compressed Air Challenge
Fundamentals of Compressed Air Systems WE (web-edition)	November 9, 2011	Online Training	—

Editor's Note: If you conduct compressed air system training and would like to post it in this area, please email your information to rod@airbestpractices.com.

PRODUCTS

Parker domnick hunter ThermalStar Smart Mass Cycling Dryer

Costly compressed air contamination problems can be avoided by installing a Parker domnick hunter ThermalStar Smart Thermal Mass Cycling Refrigerated Air Dryer package complete with OIL-X EVOLUTION filtration. The combination of the thermal mass dryer and high quality filtration provides air quality to ISO 8573.1 Class 1.4.1. ThermalStar Smart perfectly and continuously adapts to the actual operating conditions, ensuring perfect dewpoint control together with the lowest operating costs. Over and above this extreme flexibility of use, ThermalStar Smart's advanced technical solutions offer reliability, efficiency, energy savings, compact dimensions and low weight, making it the ideal solution for all industrial users.

Contact Parker domnick hunter,
tel: 276-655-4796, www.parker.com/pdf

RESOURCES FOR ENERGY ENGINEERS

PRODUCTS

Rogers Machinery Announces New Kobelco KNW Series 00

Rogers Machinery Company announced the new Kobelco KNW Series 00 frame oil-free compressor. It is the world's only two stage, oil-free, rotary screw air compressor in the 20–50 horsepower size. The package has been designed based on feedback from customers in the hospital, laboratory and university markets.

Contact Rogers Machinery,
tel: 503-639-0808,
email: kobelco@rogers-machinery.com,
www.knw-series.com

Solberg STS Liquid Separator

Solberg presented the STS Liquid Separator. The product is a liquid knockout trap with a see-through container and drain. The STS product protects vacuum systems in harsh environments including meat packing, soil remediation and vacuum sewer applications. Connection sizes available in 2"–4". Contact Solberg with your challenging applications.

Contact Solberg Manufacturing,
tel:630-616-4400,
www.solbergmfg.com

Kaeser Announces New Com-paK Plus™ Blower Models

Kaeser has launched two additions to its Com-paK Plus™ family of blower packages. Like all Com-paK's, the new EB 291C and EB 421C models offer side-by-side installation and very low noise and vibration in a robust industrial design. These units feature Kaeser's proven tri-lobe blowers and are built for many years of trouble-free service. An enhanced airflow design improves both efficiency and heat removal, and the EB series packages have a reduced footprint — Kaeser's most compact design ever.

Further, the EB series now has the most advanced control options available, including the Omega Control Basic,™ variable frequency drive and reduced current (wye-delta) starting. A variety of sensor and instrument choices make the Com-paK Plus the first ready-to-operate, self-protecting, fully integrated blower package on the market.

All of the instrumentation is mounted, piped and wired. The controller integrates motor starters and instrumentation, which reduces installation cost and provides assurance that the package will run the first time, every time. Dry contacts are included for output to SCADA and the packages can be remotely started and stopped. EB units are available from 25 to 100 hp and with flows from 577 to 1420 icfm at 4.4 psig.

For more information on the benefits of the new EB series with integrated controller, please call 877-596-7138 or visit us at www.kaeser.com/omega.

Contact Kaeser Compressors, tel: 877-596-7138, e-mail: info.usa@kaeser.com, www.kaeser.com/omega

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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 June 20, 2011.

JUNE 20, 2011 PRICE PERFORMANCE	SYMBOL	OPEN PRICE	1 MONTH	6 MONTHS	12 MONTHS	DIVIDEND (ANNUAL YIELD) 12 MONTHS
Parker-Hannifin	PH	$85.14	$85.09	$85.03	$58.30	1.73%
Ingersoll Rand	IR	$43.55	$48.38	$47.00	$39.88	0.76%
Gardner Denver	GDI	$77.90	$78.48	$69.05	$48.36	0.26%
Atlas Copco ADR	ATLCY	$21.49	$22.28	$22.50	$14.57	2.94%
United Technologies	UTX	$85.51	$86.41	$79.38	$70.34	2.27%
Donaldson	DCI	$56.26	$59.40	$59.14	$44.98	1.08%
SPX Corp	SPW	$77.79	$79.59	$71.91	$58.53	1.31%

GARDNER DENVER, INC. DELIVERS RECORD FIRST QUARTER 2011 FINANCIAL RESULTS

Company Reports Record-Level Quarterly Revenues, Orders, Backlog and Operating Income and Highest First Quarter Net Income and DEPS in Company History.

Company Highlights (Attributable to Gardner Denver):

- Diluted Earnings per Share ("DEPS") were $1.13 for the first quarter of 2011, inclusive of profit improvement costs and other items totaling $0.02, an increase of 85% compared to $0.61 in the first quarter of 2010
- Strong first quarter growth, with orders of $611.9 million and revenues of $531.9 million, both up 26% compared to the first quarter of the prior year
- Operational improvements contribute to 510 basis points of operating margin expansion to 16.3%
- Backlog ended the quarter at $647.1 million, an increase of $207.2 million (47.1%) from the first quarter of 2010 and $93.6 million (16.9%) from year end
- Updated guidance for 2011: second quarter DEPS of $1.10 to $1.15 and total year DEPS of $4.50 to $4.60, including profit improvement costs and other items totaling $0.05 per diluted share for the second quarter and $0.10 per diluted share for the full year

Gardner Denver, Inc. (NYSE: GDI) announced that revenues and operating income for the three months ended March 31, 2011 were $531.9 million and $86.8 million, respectively, which are record quarterly results for the Company. For the first quarter of 2011, net income and DEPS attributable to Gardner Denver were $59.5 million and $1.13, respectively, which are the highest levels achieved by the Company for any first quarter in its history. The three-month period of 2011 included expenses for profit improvement initiatives and other items totaling $1.7 million, or $0.02 DEPS.

Compared to the three-month period of 2010, revenues and orders both increased 26%. Demand for Engineered Products remained strong, with the most significant increases resulting from greater demand for petroleum pump products, engineered packages destined for emerging markets and OEM products. Demand for Industrial Products was broad-based, growing by double-digits in every major region of the world. Consolidated operating income improved 83% compared to the three-

month period of the prior year, increasing to $86.8 million from $47.5 million in 2010. Operating income as a percentage of revenues was 16.3% in the three-month period of 2011, compared to 11.2% in the prior year period. The increase in operating income was largely driven by incremental profitability on the revenue growth, favorable product mix and the benefits of operational improvements previously implemented.

"I am very pleased with the record-breaking financial results achieved by the Company in the first quarter, reflecting strong organic growth in our end markets and solid execution by our employees worldwide, supported by the principles of the Gardner Denver Way," said Barry L. Pennypacker, Gardner Denver's President and Chief Executive Officer. "Our global teams remain focused on the Company's five strategic priorities and driving operational excellence throughout the organization. These improvements were evident in the first quarter, as operating margins expanded by 510 basis points compared to the prior year, with outstanding results in both of our reportable segments. The Industrial Products Group achieved its eighth consecutive quarter of increased operating margins to 11.3% (as adjusted to exclude the impact of impairment charges, expenses for profit improvement initiatives and other items), sustaining its great progress toward our goal of 14% by 2014. The Engineered Products Group also delivered outstanding growth, doubling operating income in the first quarter of 2011, compared with the same period of 2010.

"The Company is well-positioned for continued organic growth. We continue to invest resources in our manufacturing facilities and are expanding our presence in key emerging markets and attractive end markets such as energy, medical, environmental and food and beverage. Furthermore, we continue to make progress on growing aftermarket revenues, with a particular focus on key end markets such as energy and infrastructure and expanding our service capabilities worldwide, as evidenced by our decision to invest in a new world class aftermarket facility for petroleum pumps in Fort Worth, Texas." Mr. Pennypacker continued, "In the first quarter of 2011, cash provided by operating activities was more than $47 million, compared to $27 million in the same period of 2010. We invested $8.0 million in capital expenditures in the first three months of 2011, with a focus on increasing production output to meet strong demand from our customers and reducing costs. We anticipate total capital expenditures will be approximately $45 million in 2011, reflecting continued investments in growth initiatives and margin expansion projects on the shop floor. Our balance sheet and cash generation remains strong, and we will continue to be selective in our acquisitions if the appropriate opportunities become available."

Gardner Denver also announced today that it has reached an agreement with the minority shareholders of its two joint ventures in China, Shanghai CompAir Compressor Co. Ltd. ("SCCC") and Shanghai CompAir-Dalong High Pressure Equipment Co. Ltd. ("SCDL"), to acquire all of their equity interests in the joint ventures. The noncontrolling interests held by the minority shareholders of SCCC and SCDL are 49% and 40%, respectively, of the outstanding share capital of the entities. The purchase price for the noncontrolling interests is RMB 122 million (approximately $18.7 million) and will be paid with Gardner Denver's existing cash on hand in China.

Gardner Denver is currently the majority shareholder of the two joint ventures and includes their total results in the Company's consolidated financial statements, with a reduction to net income attributable to Gardner Denver for the earnings attributable to the noncontrolling interests. The transaction is expected to increase DEPS attributable to Gardner Denver common stockholders in the second half of 2011 by approximately $0.02. The transaction remains subject to various regulatory approvals and is expected to close in the third quarter of 2011.

"I am very pleased with the record-breaking financial results achieved by the Company in the first quarter, reflecting strong organic growth in our end markets and solid execution by our employees worldwide, supported by the principles of the Gardner Denver Way."

— Barry L. Pennypacker, Gardner Denver's President and Chief Executive Officer

WALL STREET WATCH

"As capacity utilization grows, we are optimistic that we will see expansion of customer plants that will drive demand for the Industrial Products Group's compressors and vacuum products."

— Barry L. Pennypacker, Gardner Denver's President and Chief Executive Officer

Mr. Pennypacker stated, "For the remainder of 2011, we expect that capacity utilization will continue to improve gradually, which will drive demand for the products and services of our Industrial Products Group, particularly replacement opportunities. As capacity utilization grows, we are optimistic that we will see expansion of customer plants that will drive demand for the Industrial Products Group's compressors and vacuum products.

"Our backlog for the Engineered Products segment has improved in the past two quarters, giving us better visibility into the demand for the balance of 2011. We anticipate demand for well servicing pumps and aftermarket fluid ends to remain strong in 2011, compared to 2010, and we are continuing to invest in production capacity to meet these growing requirements. We are expecting a stable rig count for the remainder of 2011 and shipments of drilling pumps to remain steady."

Mr. Pennypacker stated, "Based on this economic outlook, our existing backlog and productivity improvement plans, we are projecting the second quarter 2011 DEPS attributable to Gardner Denver to be in a range of $1.10 to $1.15 and are raising our full-year 2011 DEPS range to $4.50 to $4.60. This projection includes profit improvement costs and other items totaling $0.05 per diluted share for the second quarter of 2011 and $0.10 per diluted share for the full-year 2011. Second quarter 2011 DEPS attributable to Gardner Denver, adjusted to exclude profit improvement costs and other items, are expected to be in a range of $1.15 to $1.20. The midpoint of the adjusted DEPS range for the second quarter of 2011 ($1.18) represents a 62% increase over the same period of 2010. Full-year 2011 DEPS attributable to Gardner Denver, adjusted to exclude profit improvement costs and other items, are expected to be in a range of $4.60 to $4.70. The midpoint of the new adjusted DEPS range for the full-year 2011 ($4.65) represents a 37% increase over 2010 results and a 13% increase from the full-year 2011 guidance previously issued.

First Quarter Results Revenues increased $109.7 million (26%) to $531.9 million for the three months ended March 31, 2011, compared to the same period of 2010. Organically, order and revenue growth were 24% and 23%, respectively, in the first quarter of 2011, compared to the prior year period.

Orders and revenues for the Industrial Products segment both increased 16% in the first quarter, compared to the same period of 2010, reflecting on-going improvement in demand for OEM products, compressors and aftermarket parts and services. The segment experienced double-digit growth in each of the major regions of the world, with particular strength in the Americas and Asia. In the first quarter of 2011, favorable changes in foreign currency exchange rates increased orders and revenues for the Industrial Products segment by 2%. Organically, this segment generated order and revenue growth of 14% in the first quarter of 2011, compared to the prior year period.

Engineered Products segment orders and revenues increased 39% and 40%, respectively, for the three months ended March 31, 2011, compared to the same period of 2010, reflecting strong demand for drilling and well servicing pumps and medical OEM products. In the first quarter of 2011, favorable changes in foreign currency exchange rates increased orders and revenues for the Engineered Products segment by 1%. The ILMVAC acquisition, completed in the third quarter of 2010, increased orders and revenues by 2% and 3%, respectively. Organically, this segment generated both order and revenue growth of 36% in the first quarter of 2011, compared to the prior year period.

Gross profit increased $50.6 million (38%) to $184.5 million for the three months ended March 31, 2011, compared to the same period of 2010, primarily as a result of volume improvements, favorable product mix, cost reductions and favorable changes in foreign currency exchange rates. Gross margin increased to 34.7% in the three months ended March 31, 2011, from 31.7% in the same period of 2010. The increase in gross margin was due to the benefits of operational improvements, cost reductions, volume leverage and favorable product mix.

Selling and administrative expenses increased $8.3 million to $96.0 million in the three-month period ended March 31, 2011, compared to the same period of 2010, primarily due to increases in compensation and benefit expenses and unfavorable changes in foreign currency exchange rates ($1.2 million), partially offset by cost reductions. The ILMVAC acquisition, completed in the third quarter of 2010, added $1.0 million to selling and administrative expenses in the first quarter of 2011. As a percentage of revenues, selling and administrative expenses improved 270 basis points to 18.1% for the three-month period ended March 31, 2011, compared to the same period of 2010.

Depreciation and amortization expense was $14.9 million for the three-month period of 2011 and $15.6 million in the three-month period of 2010.

Operating income, as adjusted to exclude the net impact of expenses incurred for profit improvement initiatives and other items ($1.7 million) ("Adjusted Operating Income") for the three-month period ended March 31, 2011 was $88.5 million, compared to $48.5 million in the prior year period. Adjusted Operating Income as a percentage of revenues improved to 16.6% from 11.5% in the three-month period of 2010. DEPS attributable to Gardner Denver, as adjusted for the impact of profit improvement costs and other items ("Adjusted DEPS") for the three-month period ended March 31, 2011, were $1.15, compared to $0.62 in the three-month period of 2010.

Adjusted Operating Income for the Industrial Products segment in the first quarter of 2011 was $32.2 million and segment Adjusted Operating Income as a percentage of revenues was 11.3%. By comparison, Adjusted Operating Income for the Industrial Products segment was $20.5 million, or 8.3% of revenues, in the three-month period of 2010. Segment operating income(1) and segment operating margin(1), as reported under GAAP, for the Industrial Products segment for the three months ended March 31, 2011 were $30.8 million and 10.8%, respectively. Segment operating income (1) and segment operating margin(1) for the Industrial Products segment, as reported under GAAP, for the three months ended March 31, 2010 were $19.6 million and 7.9% of revenues, respectively. The improvement in Adjusted Operating Income for this segment was primarily attributable to incremental profit on revenue growth and cost reductions. See the "Selected Financial Data Schedule" and the "Reconciliation of Operating Income and DEPS to Adjusted Operating Income and Adjusted DEPS" at the end of this press release.

Adjusted Operating Income for the Engineered Products segment for the first quarter of 2011 was $56.3 million and segment Adjusted Operating Income as a percentage of revenues was 22.9%. Adjusted Operating Income for the 5 Engineered Products segment in the three-month period of 2010 was $28.0 million, or 16.0% of revenues. Segment operating income(1), as reported under GAAP, for the Engineered Products segment for the three months ended March 31, 2011 was $56.0 million and segment operating margin(1) was 22.8%, compared to $27.9 million and 15.9%, respectively, in the same period of 2010. The improvement in Adjusted Operating Income

"During the quarter we completed two acquisitions that are excellent strategic fits with our Flow Technology and Test and Measurement segments, and we remain well positioned to make future strategic investments."

— Christopher J. Kearney, Chairman, President and Chief Executive Officer of SPX

WALL STREET WATCH

for this segment was primarily attributable to incremental profitability on revenue growth, favorable product mix and cost reductions. See the "Selected Financial Data Schedule" and the "Reconciliation of Operating Income and DEPS to Adjusted Operating Income and Adjusted DEPS" at the end of this press release.

The provision for income taxes for the three months ended March 31, 2011 increased $12.8 million to $22.5 million, compared to the same period of 2010. The effective tax rates for the three-month periods of 2011 and 2010 were 27% and 23%, respectively.

Net income attributable to Gardner Denver for the three months ended March 31, 2011 increased $27.5 million to $59.5 million, compared to $32.0 million in the same period of 2010. Diluted earnings per share attributable to Gardner Denver for the three months ended March 31, 2011 were $1.13, compared to $0.61 for the same period of the previous year.

SPX Reports 1st Quarter 2011 Earnings

SPX Corporation (NYSE: SPW) reported results for the first quarter ended April 2, 2011:

First Quarter Highlights:

- Revenues increased 10.5% to $1.20 billion from $1.08 billion in the year-ago quarter. Organic revenues increased 5.8%, while completed acquisitions and currency fluctuations increased revenues by 2.6% and 2.1%, respectively
- Segment income and margins were $114.5 million and 9.5%, compared with $106.5 million and 9.8% in the year-ago quarter
- Diluted net income per share from continuing operations was $0.49, compared with $0.37 in the year-ago quarter
- Net cash used in continuing operations was $35.4 million, compared with $25.2 million in the year-ago quarter. The increase was due primarily to investments in working capital, which more than offset an increase in operating income
- Free cash flow from continuing operations during the quarter was a negative $51.8 million, compared with a negative $37.0 million in the year-ago quarter. The decline was due primarily to the items noted above, in addition to higher capital expenditures in 2011

"In the first quarter of 2011, we achieved financial results that were largely in line with our expectations," said Christopher J. Kearney, Chairman, President and Chief Executive Officer of SPX. "Organic growth in the quarter was driven by continued strength in our early cycle businesses, partially offset by declines in our late cycle power and energy businesses. We are encouraged by positive order trends for power transformers and continued strong orders in our Flow Technology segment. During the quarter we completed two acquisitions that are excellent strategic fits with our Flow Technology and Test and Measurement segments, and we remain well positioned to make future strategic investments. Looking ahead, we anticipate steady sequential improvement and a much stronger second half for SPX. For the full year, we expect a return to growth for both organic revenue and earnings. Our outlook for the year has improved modestly, and as such we have raised our earnings per share guidance range to $4.25 to $4.55 from the previous range of $4.20 to $4.50 per share. Our free cash flow guidance remains at $220 to $260 million," added Kearney.

Flow Technology

Revenues for the first quarter of 2011 were $455.9 million compared to $354.0 million in the first quarter of 2010, an increase of $101.9 million, or 28.8%. Organic revenues increased 18.1%, reflecting strong demand across the majority of the segment's end markets. This was led by sales of large-scale systems and components for the food and beverage market and components for the power and energy market. The 2010 acquisitions of Anhydro and Gerstenberg Schroeder increased reported revenues by 7.5%, while the impact of currency fluctuations increased reported revenues by 3.2%, from the year-ago quarter.

Segment income was $56.4 million, or 12.4% of revenues, in the first quarter of 2011 compared to $41.3 million, or 11.7% of revenues, in the first quarter of 2010. Segment income and margin increased due primarily to the organic growth noted above.

Test and Measurement

Revenues for the first quarter of 2011 were $248.9 million compared to $204.4 million in the first quarter of 2010, an increase of $44.5 million, or 21.8%. Organic revenues increased 20.2%, driven primarily by increased sales of diagnostic and service tools to vehicle manufacturers and their dealer service networks. The impact of currency fluctuations increased reported revenues by 1.6% from the year-ago quarter.

Segment income was $19.6 million, or 7.9% of revenues, in the first quarter of 2011 compared to $13.4 million, or 6.6% of revenues, in the first quarter of 2010. The increase in segment income and margins was due primarily to the impact of the organic revenue increase noted above.

Thermal Equipment and Services

Revenues for the first quarter of 2011 were $325.3 million compared to $352.4 million in the first quarter of 2010, a decrease of $27.1 million, or 7.7%. Organic revenues declined 9.9% in the quarter, driven primarily

by lower revenue from cooling systems, particularly high-margin dry cooling projects in China. The impact of currency fluctuations increased reported revenues by 2.2% from the year-ago quarter.

Segment income was $21.3 million, or 6.5% of revenues, in the first quarter of 2011 compared to $31.7 million, or 9.0% of revenues, in the first quarter of 2010. The decline in segment income and margins was due primarily to the impact of the organic revenue decline noted above.

Industrial Products and Services

Revenues for the first quarter of 2011 were $168.9 million compared to $173.8 million in the first quarter of 2010, a decrease of $4.9 million, or 2.8%. Organic revenues declined 3.9% in the quarter, driven primarily by volume and pricing declines for power transformers partially offset by revenue growth in solar crystal growers and hydraulic tools. Completed acquisitions increased reported revenues by 0.8%, while the impact of currency fluctuations increased reported revenues by 0.3%, from the year-ago quarter.

Segment income was $17.2 million, or 10.2% of revenues, in the first quarter of 2011 compared to $20.1 million, or 11.6% of revenues, in the first quarter of 2010. The decrease in segment income and margins was due primarily to the organic declines noted above, most notably the pricing decline for power transformers. This was partially offset by an insurance recovery of $6.3 million related to a product liability matter that was settled in 2007. BP

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A Publication of: Smith Onandia Communications LLC
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Pittsburgh, PA 15241

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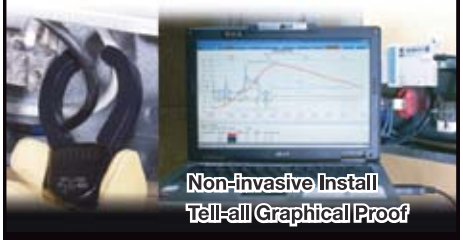

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Also, in order to address the interests and needs of the large number of U.S. government professionals who traditionally attend WEEC, AEE will again offer a section of the program known as **FEMWorks 2011.** This special multi-track portion of the WEEC conference will include a comprehensive series of workshops for federal energy managers.

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FEATURED KEYNOTE SPEAKERS

OPENING SESSION

Welcome From AEE
Albert Thumann, P.E., C.E.M.,
Executive Director,
Association of Energy Engineers

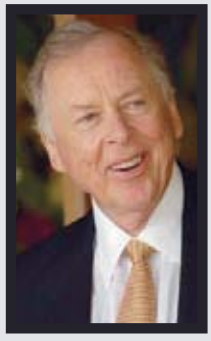
Green Solutions that Meet the Needs of Today's Property Owners
Peter Belisle
President, Energy & Sustainability Services, Jones Lang LaSalle

The Great Ocean's: Conservation & Sustainable Management
Alexandra Cousteau
Environmental Advocate & Water Policy Expert

ComEd's Environmental Achievements & Future Outlook
Val Jensen
Vice President of Marketing & Environmental Programs, ComEd

KEYNOTE LUNCHEON

Powering Our Energy Future: A Conversation with T. Boone Pickens
T. Boone Pickens
BP Capital Management



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