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August/September 2009

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SUSTAINABLE MANUFACTURING FEATURES

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FROM THE EDITOR

Food Packaging

The food packaging industry is a major user of compressed air and nitrogen systems. We have designed the content of this edition with the goal of providing Energy Engineers with valuable information on how to reduce their energy costs while ensuring the compressed air and nitrogen quality of their systems.

The System Assessment of the Month, written by Mr. Ron Marshall of Manitoba Hydro, details the work he did for a snack food manufacturer. The company was looking at an expansion of their nitrogen generation systems to enable nitrogen insertion into all of the bagging machines. As a result of the assessment, the company was able to reduce their energy consumption by 50% while actually increasing their compressed air and nitrogen generation capacity!

Ensuring the quality of compressed air is essential for food packagers and processors who bring the compressed air into direct and indirect contact with food. Mr. Jay Francis, of SPX Dehydration and Filtration, provides us with an informative "Discussion" on ISO Air Quality Standards (ISO 8573.1 and ISO 12500 Parts 1-3). Also included in our Pneumatic Advantage column is an article on "Washdown Pneumatics" and how Bosch Rexroth and Evergreen Packaging teamed up to design a machine that avoids contamination and reduces downtime.

Heat recovery is proving to be one of the largest energy efficiency opportunities in the industry. Atlas Copco Compressors has launched a new "Carbon Zero Air Compressor" product line, which enables end users to use the heat generated in their air compressors to heat process water in factories. We had the opportunity to interview Peter Kyriacopoulos of Atlas Copco about this exciting energy efficiency opportunity in our "Technology Provider" column.

Due to popular demand, we continue our series called "The 7 Sustainability Projects for Industrial Energy Savings", with an article provided to us by Mr. Ted Stouch of Stouch Lighting. In it, Mr. Stouch teaches us how to reduce the energy costs of outdoor lighting installations.

Last but not least, the NPE2009 International Plastics Showcase gave us the opportunity to familiarize ourselves with the sustainability initiatives of the big manufacturers of equipment for bottling lines, like Sidel, Milacron and Krones. We were impressed by their new "Air Recovery and Recycling" product upgrades on their blow molding machines, enabling users to reclaim compressed air and reduce their air consumption by up to 40%.

New "Carbon Zero" air compressors enable end users to have net zero energy consumption from their rotary screw air compressors.

We hope you enjoy this edition and thank you again for your support and for investing in industrial energy efficiency.

ROD SMITH
Editor
rod@airbestpractices.com

SUSTAINABLE MANUFACTURING NEWS

Unilever, Campbell's, MEADWESTVACO, Hormel Foods, Sara Lee

SOURCED FROM THE WEB

Unilever Addresses Climate Change

The issue

Climate change is one of the most serious issues facing the world. Extreme weather patterns and water scarcity will affect people everywhere, with developing countries likely to be among the most vulnerable.

There will be serious consequences for our business operations, including threats to our agricultural supply chain and the availability of water in some of our markets.

The costs of addressing climate change now, while considerable, are likely to be far less challenging than waiting and allowing the problem to get worse.

We have joined business coalitions endorsing the need for action.

Our approach

In 2007, the Unilever Executive agreed on a greenhouse gas strategy.

Our approach to reducing our greenhouse gas emissions addresses both our direct and indirect impacts.

For our direct impact, we seek to:

- Reduce CO_2 from energy in our manufacturing operations by 25% by 2012 (measured per ton of production against a 2004 baseline). This builds on our reductions to date

For our indirect impact, we seek to:

- Improve the footprint of our existing product portfolio, using our new vitality metric
- Assess innovations using our greenhouse gas profiling tool
- Work with our customers and suppliers to address our wider impact

Our carbon footprint

We estimate Unilever's total emissions of greenhouse gases from our own factories, offices, laboratories and business travel to be equivalent to 4 million tons of CO_2 per year. Our wider footprint from sourcing agricultural and chemical raw materials can amount to around 10 times as much as our emissions, and, in consumer use and disposal of products, this may reach 30 to 60 times as much, based on certain assumptions about how consumers use our products.

Our direct impact — Greenhouse gas emissions in manufacturing

Since 1995, we have achieved a 39% reduction in CO_2 from energy per ton of production (equivalent to a 43% reduction in absolute terms). In 2008, we reduced our CO_2 emissions by 2.2% per ton of production as compared to 2007. This keeps us on track to meet our 2012 target.

We continue to work towards our 2012 target by investing in more efficient power and steam generation technology and through the development of less energy-intensive manufacturing processes. Our approach has been to target those sites that emit the most CO_2.

In Europe, we now have three combined heat and power plants operational in Caivano and Cisterna, Italy, and Stavenhagen, Germany. These plants are more environmentally efficient than importing electricity from the national supplier because they fully utilize the waste steam and hot water from electrical power generation. We are planning to install additional co-generation facilities in Europe to reduce regional greenhouse gas emissions.

We are exploring alternative technologies in other regions too. For example, at our Cu Chi factory in Vietnam, we installed solar panels to preheat water for steam generation.

As well as capital investment in more energy-efficient technology, raising awareness and encouraging behavior change are also important factors in reducing emissions. Simple practices such as turning off lighting, heating and equipment when not needed and reporting steam and compressed air leaks can deliver big energy savings. During 2008, we conducted workshops to share good practices and raise technical capabilities awareness in each region.

Source: www.unilever.com

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SUSTAINABLE MANUFACTURING NEWS

Unilever, Campbell's, MEADWESTVACO, Hormel Foods, Sara Lee

"In 2005, we set a goal to reduce the energy required to produce our products in our largest area of operation, North America, by 10% by 2010."

— Campbell's

Campbell's Promotes Sustainable Manufacturing

Campbell has a company-wide program to manage the environmental impact of our 38 manufacturing facilities. To integrate environmental management through all business operations worldwide, our program sets goals for energy and water conservation, waste management and recycling.

We have implemented programs to measure our progress at each of our facilities. Plants develop individual action plans that must be executed within six months. The criteria we use to measure environmental compliance at each of our plants is updated on a regular basis to reflect emerging concerns and new regulations. To help ensure that our audits are conducted according to current standards, we joined the International Audit Protocol Consortium (IAPC) in 2001.

Energy Use and Greenhouse Gas (GHG) Emissions

As a food company that relies on a consistent supply of high-quality agricultural crops, Campbell is deeply concerned about the risks posed by climate change. To reduce the amount of energy consumed and the associated costs to Campbell, we have implemented a number of initiatives to reduce our energy use globally through a combination of energy reduction targets, new low-energy technologies and alternative fuels.

In 2005, we set a goal to reduce the energy required to produce our products in our largest area of operation, North America, by 10% by 2010. Teams based in our plants and charged with meeting this goal have already reduced total energy consumption by 7% through initiatives such as energy audits, heat recovery projects and leak-detection techniques. Capital projects are currently being implemented to further improve the efficiency of our energy use, to eliminate waste and to reduce the energy required in our manufacturing processes.

In August 2006, Campbell joined the U.S. EPA Climate Leaders program, a national voluntary effort to reduce GHG emissions. As a Climate Leader Partner, Campbell is committed to taking the following measures:

- Develop an inventory of the six major greenhouse gases and report progress annually based on detailed EPA protocols and guidance
- Develop a corporate GHG inventory management plan based on a detailed EPA checklist to institutionalize the inventory process
- Set an aggressive, companywide GHG emissions reduction goal to be achieved over the next five to 10 years
- Track and report 100% of the emissions from facilities and operations over which Campbell has financial control

As of December 2007, we had completed an inventory of all U.S. facilities and calculated the direct and indirect GHG emissions related to our use of fuel and electricity. We are currently reviewing this data with Climate Leaders to ensure the quality of our baseline emissions data. We are on track to complete this process and to set our GHG reduction goals by August 2008.

Source: www.campbellsoupcompany.com

MWV MEADWESTVACO

MEADWESTVACO Lowers Carbon Dioxide Emissions

We are fulfilling our responsibility to lower emissions through our voluntary, legally binding commitment to reduce direct carbon dioxide equivalents from a 1998–2001 baseline by 6% by the end of 2010, through our participation in the Chicago Climate Exchange.

Further, MWV is committed to doing its part toward our trade association's (American Forest & Paper Association) Climate VISION commitment to a 12% reduction in relative CO_2 emissions ("intensity") for major production facilities between 2000 and the end of 2012. We share our progress with investors through such organizations as SAM for inclusion in the Dow Jones Sustainability World Index, and also through the Carbon Disclosure Project, where we have publicly participated since the S&P 500 were invited to CDP4.

MWV is working on many levels to reduce greenhouse gases. We use carbon neutral, renewable biomass-based byproducts for 67% of all energy requirements at our significant United States manufacturing facilities. We self- or co-generate 72% of the total electricity required by our U.S. integrated paper mills, of which 73% is derived from renewable sources.

Actively reducing carbon dioxide emissions enables us to lessen our use of fossil fuels. We evaluate our new capital projects to ensure that we will meet our CO_2 reduction goals, and fund projects to reduce energy costs and CO_2 emissions. We also develop and use products that reduce carbon dioxide emissions, including the wood-based carbon products from our Specialty Chemicals business.

MWV is a member of Duke University's Climate Change Policy Partnership, an industry-university collaboration designed to help inform policy makers in decisions involving climate change.

Source: www.meadwestvaco.com

SUSTAINABLE MANUFACTURING NEWS

Unilever, Campbell's, MEADWESTVACO, Hormel Foods, Sara Lee

Hormel Foods Reduces Energy 2% Per Year

Hormel Foods is committed to reducing the impact that our day-to-day operations have on the environment and to promoting animal welfare.

Energy is used in most phases of our operations for lighting, operating equipment, heating and cooling. To reduce energy use and limit carbon dioxide emissions, Hormel Foods conducts a baseline analysis on one third of our facilities annually. Based on this information, we established benchmarks for 41 facilities to measure energy use and greenhouse gas emissions and plan energy efficient projects to target ways we can conserve and improve energy use.

All of our U.S. manufacturing facilities uphold Hormel Foods' commitment to compliance and look for ways to reduce their environmental impact.

To track and monitor our progress toward meeting environmental requirements, a web-based Environmental Management System is used throughout the company. This system includes compliance calendars, policy and procedure information and environmental training materials. To go beyond environmental requirements, we established the following goals:

Focus	Benchmark	Time Frame
Diversity	Promote a more diverse and inclusive workplace	FY 2008, ongoing
Supplier Diversity	Implement a supplier diversity program	FY 2008
Benchmarks	Establish individual benchmarks for measuring energy, solid waste, air, water and wastewater at all 41 facilities	FY 2008
Water Consumption	Reduce water consumption at all Hormel Foods plants and subsidiaries once benchmarks are established at the beginning of FY 2009	2 percent per year for five years
Solid Waste	Increase recycling to 40 percent of total waste	November 2008
Solid Waste	Increase recycling to 50 percent of total waste	November 2011
Energy Consumption	Reduce energy use at all Hormel Foods plants and subsidiaries by 10 percent once benchmarks are established at the beginning of FY 2009	2 percent per year for five years

Our Goals

Water Consumption: Reduce water consumption at all 41 U.S. manufacturing facilities by 2% per year for five years, after benchmarks are established at the beginning of fiscal year 2009.

Solid Waste: Increase recycling to 40% by November 2008 and to 50% by November 2011. Reduce solid waste to landfills by 2% per year through 2012.

Energy Consumption: Reduce energy use at our 41 U.S. manufacturing facilities by 2% per year for five years, after benchmarks are established at the beginning of fiscal year 2009.

Source: www.hormelfoods.com

Sara Lee

Environmental management at Sara Lee Environmental Compliance Assurance has been an integral part of Sara Lee businesses throughout the history of the company. In the 1990s, we organized our compliance programs into Sara Lee's Global Environmental Management System, or GEMS. GEMS has been used as a platform for certification of our operations under ISO 14001 at 13 facilities in Europe and Asia. Soon after implementation of GEMS, we began to collect performance metrics annually in our Global Environmental Performance Measurements (GEPM) database. Since 2002, GEPM data has been used to drive performance improvements in our operations. Our GEPM data was compiled through the collective efforts of facility-based and corporate staff. Quarterly data is now entered into the central database, then reviewed and validated to confirm data accuracy.

Based on consumer preferences, we have introduced many new products in the past few years, such as our Senseo single-serve coffee products, which require more energy per ton of production. Yet, despite such ongoing product innovations, we have maintained our current energy consumption and are continuously seeking opportunities for future reductions.

In addition, we are developing goals to strategically focus on reducing energy use by increasing the efficiency of our facilities. We continue to review our global energy consumption to identify energy reduction opportunities. Following are examples of energy reductions and efficiencies achieved through programs run by our employees around the world.

Daily activities where energy conservation is practiced include the use of energy-efficient lighting and equipment, reduction in compressor air leaks and training to encourage employees to find ways to conserve energy.

In 2002, we introduced an Operational Equipment Efficiency (OEE) metric in our North America retail plants. Used globally today, OEE determines the overall effectiveness of equipment by measuring its availability, quality and performance. Monitoring and problem solving around this metric helps reduce waste from changeovers and equipment shutdowns. OEE improvements in the Bakery Group have been 10%. BP

Source: www.saralee.com

THE SYSTEM ASSESSMENT OF THE MONTH

Snack Food Manufacturer Save 50% on Compressed Air and Nitrogen System Energy Costs

BY RON MARSHALL, CET, CIM, MANITOBA HYDRO

August/September System Assessment of the Month

Where: Manitoba, Canada
Industry: Snack Food Manufacturing
Issues: Nitrogen System and Inappropriate Blow-Off Air
Audit Type: Nitrogen and Compressed Air System

System Assessment Win/Win Results*

Reduction in Energy Use: 784,922 kWh
Reduction in CO_2 Emissions: 560 metric tons
Equivalent CO_2 for Homes: 74 homes
Equivalent CO_2 for Vehicles: 103 vehicles
Total $ Savings: $32,285
Investment: $181,805
Energy Rebate: $127,000
Simple ROI: 1.7 years
*Annual energy consumption

Manitoba Hydro POWER SMART

The Existing Nitrogen and Compressed Air System

The snack food facility is running with two normally separated compressed air production systems: the main plant system and the nitrogen system.

The main plant air system provides compressed air to general air uses through a radial feed distribution system consisting of various sized pipes. This system consists of a 100 horsepower, VSD-controlled, air-cooled, lubricated, screw compressor with two storage receivers, system filters, a non-cycling refrigerated dryer and a flow controller. A spare 60 HP compressor exists for emergencies, but is not normally run as it is in poor condition. A normally closed emergency tie connection exists from the nitrogen system, to be used in case of a nitrogen compressor failure. The air system is pressurized at a 120 psi set point for an average of 7,455 hours per year. The system is turned off on weekends and during holidays as no air is required after production or cleanup operations have ceased.

The nitrogen system provides nitrogen to the packaging area and blankets cooking oil in storage. This system consists of a load/unload controlled, fixed-speed, 55 kW (75 HP), air-cooled, lubricated, screw compressor with a single storage receiver, system filters and a non-cycling refrigerated dryer. The compressed air is used by a bank of two Pressure Swing Adsorption (PSA)-type nitrogen generators that absorb the oxygen and output nitrogen at a purity level of 99.5% or higher.

This system is pressurized at an average of 139 psi on a 24 x 7 basis for 8,760 hours per year to provide continuous nitrogen for cooking oil storage.

Based on site measurements, the estimated total system storage receiver capacitance for the air system is 1,260 gallons, or 11.6 cubic feet, per psi. The estimated capacitance for the nitrogen system on the air side is 240 gallons, or 2.2 cubic feet, per psi. The nitrogen discharge side has 2 x 240 gallon receivers for buffer duty, but this is not seen by the output of the system as there is separation due to pressure regulation. There is essentially zero storage capacity on the nitrogen discharge, simply about 200 feet of two-inch pipe, equivalent to about 40 gallons.

General Assessment of the Existing System

The general assessment of the facility air and nitrogen systems is that there is very low system efficiency due to running two separate air production systems, with one running in an inefficient load/unload mode with limited storage capacity. The main air system has an efficient VSD-style compressor that is running with good efficiency, but there is excessive pressure drop across the system filtering and the air dryer.

Distribution system sizing is excellent with no issues found. The system piping seems to be of large enough capacity to prevent any system pressure losses. The air pressure to the main plant is passed through a flow controller that should be regulating the pressure to limit increased loading caused by artificial demand. The controller is faulty and needs to be repaired. Air leakage in the plant is consuming an estimated 22% of all air produced. There appears to be no regular leakage-control program in place in the plant.

Nitrogen represents the largest single use of compressed air in the plant. This system is displaying very poor efficiency due to an incorrect adjustment or failure in one of the units. Even though two nitrogen banks are required only 26% of the time, the units are consuming purge air between 40% and 50% of the time. This is an issue because each unit requires a significant fixed purge flow of about 70 cfm, even though the unit may be producing no nitrogen. Further, one unit, due to an internal problem and/or due to the lack of downstream nitrogen storage, continues to purge during non-production hours at an average input flow of 77 cfm, which causes the associated air compressor to run continuously at a very inefficient part of its characteristic curve.

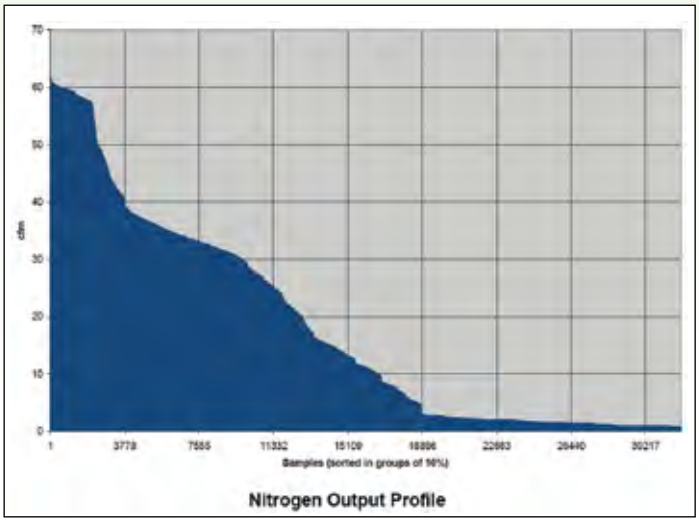
System reliability is presently questionable due to the manual nature of the compressor control and the lack of enough system back up. Neither system presently has the capability to withstand the loss of any compressor without experiencing a system outage.

There are a number of end uses that could be classified as inappropriate. An inappropriate use is a compressed air load that could be powered using a more efficient alternate source of power. The compressed air blowing on the continuous cooker line is by far the worst end use, consuming 150 cfm during testing. If this tested level represents its average consumption, it would represent about half of the average production flow. Two cabinet coolers at 25 cfm each, a conveyor belt wipe estimated at 15 cfm and the salter at 12 cfm are other end uses that could be investigated for conversion.

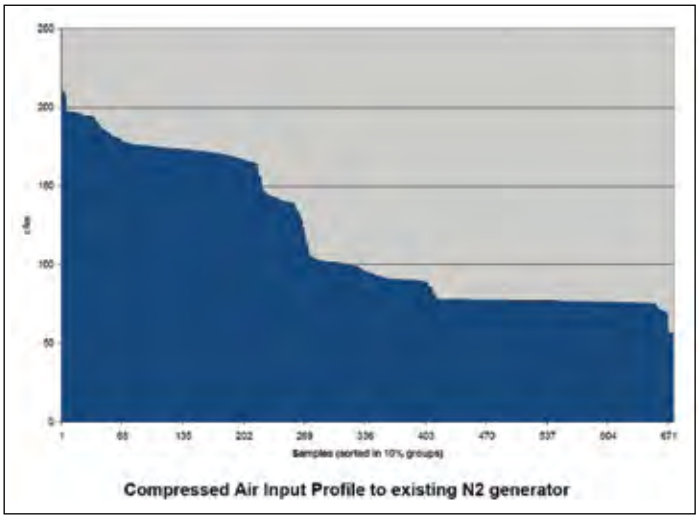
Compressor System before Assessment		Compressor System after Assessment	
Operating Hours:	8760 hours	Operating Hours:	8760 hours
Power Cost kW/h:	$0.02590	Power Cost kW/h:	$0.02590
Avg. Air Flow:	319 cfm	Avg. Air Flow:	242 cfm
Plant Air Pressure:	120 psi	Combined Plant/ Nitrogen Pressure:	130 psi
Nitrogen System Pressure:	139 psi		
Compressed Air Specific Power:	44.38 kW/100 cfm	Compressed Air Specific Power:	20.8 kW/100 cfm
Nitrogen Specific Power:	355 kW/100 cfm	Nitrogen Specific Power:	83.2 kW/100 cfm
Annual Energy:	1,225,804 kWh	Annual Energy:	440,882 kWh
Annual Energy Cost:	$65,949	Annual Energy Cost:	$33,664

THE SYSTEM ASSESSMENT OF THE MONTH

Snack Food Manufacturer Save 50% on Compressed Air and Nitrogen System Energy Costs



Nitrogen Output Profile



Compressed Air Input Profile to Existing Nitrogen Generator

The specific power of the air system is 25.96 kW/100 cfm produced. For the nitrogen system, the specific power of the air-side system is 44.38 kW/100 cfm and the nitrogen system is 355 kW/100 cfm. Normal levels would be in the 22 kW/100 cfm range for air and 110 kW/100 cfm for nitrogen. These numbers indicate some small gains can be made for the air system and some major gains can be achieved on the nitrogen side.

Due to article length limitations, we will focus on the efforts made to optimize the nitrogen generation systems and the blowing applications.

Nitrogen Base Case

Future plans call for increased nitrogen capacity to enable all bagging machines to operate using nitrogen. This will increase nitrogen system costs to higher levels than present due to the air demand caused by two additional nitrogen generators. Further, a desiccant dryer will be added to the inlet of the bank of generators to better condition the air to prevent fouling of the desiccant in the generators. These additions will further increase the operating cost of the nitrogen system. This section estimates the cost of such an increase to create a new base case for utility incentive purposes.

The profile below shows the demand usage profile for the present nitrogen demand. This profile indicates the demand is on average 15 cfm and that production demand occurs about 45% of the time. Two nitrogen generators (each rated at 30 cfm) are required 26% of the time. One nitrogen generator is required the remainder of the time, however, and it can be seen that for 55% of the time the nitrogen flow is very low, likely feeding leaks.

The readings were taken during a period of higher product demand before the Christmas period. Subsequent readings taken after the holiday period showed that average demand had fallen to about 10 cfm. However, for calculation purposes, the 15 cfm flow rate will be used as a conservative estimate.

The input air loading profile shape differs significantly from the nitrogen due to the malfunction of one of the generators and the present coordination of the pressure switches that control the units (meaning it does not track linearly). It can be seen from the graph that two generators are online consuming input air about 40% of the time, and one remains on continuously, with an input of about 80 cfm, even though the nitrogen output is very low.


18
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THE SYSTEM ASSESSMENT OF THE MONTH

Snack Food Manufacturer Save 50% on Compressed Air and Nitrogen System Energy Costs

Proposed Systems

In general, the energy reduction strategies include combining the two systems into one well-controlled system, replacing the inefficient refrigerated dryers, upgrading compressed air filters to low differential, reducing air wastage due to drainage and leaks, reducing artificial demand caused by operating at a higher pressure than required and optimizing or eliminating inappropriate uses.

Further efficiency improvements could be gained by repairing the faulty nitrogen generator, adding more efficient nitrogen generator units and adding nitrogen storage. Efficient use of nitrogen could be maintained by shutting down the feed to packaging machines during non-production hours and regulating the pressure to the machines to ensure a constant flow, even with varying nitrogen generator output pressure.

Constituents of Compressed Air Demand

The proposed system will produce air at a specific power of 20.8 kW/cfm. Nitrogen would be produced at 83.2 kW per 100 cfm. This would be a substantial increase in efficiency from the present mode of operation.

CONSTITUENTS OF DEMAND (AVG. CFM)	CURRENT PEAK CFM	CURRENT AVG. CFM	CURRENT PERCENT OF TOTAL (AVG)	PROPOSED PEAK CFM	PROPOSED AVG. CFM	PROPOSED PERCENT OF TOTAL (AVG)
Production Machines	186	72	23%	186	72	30%
Nitrogen	200	120	37%	490	120	50%
Blowing	100	45	14%	25	11	5%
Leaks	31	31	10%	20	20	8%
Pumps, Drains, Artificial Demand, Poor Applications	154	83	16%	55	19	8%
Total Avg. cfm	**640**	**319**	—	**776**	**242**	—

Reduce Compressed Air Used for Blowing

Blowing using compressed air for cleaning, drying or moving product is expensive due to the significant energy intensity involved in producing compressed air. Some blowing applications were found in the plant that could be upgraded. One application that has the most impact on the system is the blowing of the conveyor on the input to the continuous cooker. This application previously had an electric blower installed, but the unit had failed at some point in time. An alternate compressed air supply was used to supply this end use through the whole measurement period, which significantly taxed the compressed air system and pushed the compressor to maximum capacity during peak flows. Testing was done on this application and it was found to be consuming about 150 cfm. The adjustment of the ball valve on the compressed air supply is extremely sensitive, with a slight adjustment making a big change to flow. The actual average flow is somewhat in doubt. Because of this, a lower flow is used for calculation purposes. Estimated annual cost to feed this blower is $4,970 per year. Blower costs would be about $500.

Various other blowing applications using compressed air were found:

- Conveyor belt blowing near the salter — estimated at 15 cfm for production hours, only costing about $500 per year
- Blowing on conveyor at chip storage — estimated at 15 cfm for 200 hours, costing $25 per year
- Blowing to distribute chips on input to kettle cookers — estimated at 95 cfm peak but with low average of about 14 cfm, costing $460 per year
- Blowing to distribute salt on chips — estimated at 12 cfm, costing $400 per year

Install a Cycling Refrigerated Air Dryer

In most locations, some type of air drying is required because the air being produced by the compressor and passed through the after-coolers is typically saturated with water vapor. If this air is allowed to cool in the plant pipe work, the water vapor will condense and cause problems with connected machinery and processes.

Refrigerated dryers have been installed on both the air and nitrogen systems. These dryers use hot gas bypass control that keeps the refrigeration compressor constantly loaded even though the average moisture loading or the air processed by the dryer may be low. This causes the dryers to consume constant power through the full range of operation, which is inefficient.

Cycling, VSD or thermal mass dryers will vary the refrigeration compressor loading in direct proportion to moisture loading. It is recommended that the existing dryers be removed and one new, large thermal mass dryer

be installed as a replacement. If a dryer capable of processing the combined capacity of both existing compressors is chosen, there will be an added benefit of lower pressure differential due to a larger dryer being applied to a load that will be, on average, much lower than the dryer capacity.

Estimated savings for the dryer replacement would be $2,430 per year for dryer operation and about $500 per year to account for pressure differential.

Ways to Reduce Purge Air of Nitrogen Generators

The nitrogen system supplier is recommending a desiccant air dryer be installed on the air input to the nitrogen banks. The heatless desiccant dryer proposed would have a constant 90 cfm purge flow at all times, if it is not dew point controlled. A Dewpoint Dependent Switching System (DDS) is recommended on this dryer. This will result in significant savings due to the lower-than-rated average flow of the nitrogen system.

The existing nitrogen generators are pressure-swing adsorption-style units rated to supply 99.5% purity gas or better at about 30 cfm output per unit. From an energy point of view, these units consume a significant amount of air when not in standby because there is a constant supply of air required to purge the beds of molecular sieve (called desiccant in this report) internal to the dryer. About 70 to 80 cfm of air is consumed when these generators are not in standby, even though the generator may only be producing small amounts of nitrogen. It is for this reason that measures should be taken to control these units to ensure as few generator banks are online at one time and that the units are operating only as required. Once online, the system should ensure the units maintain full flow, which is their most energy efficient point, for as long as possible. It is also important to ensure the units go into standby when the system pressure is satisfied.

THE SYSTEM ASSESSMENT OF THE MONTH

Snack Food Manufacturer Save 50% on Compressed Air and Nitrogen System Energy Costs

The system supplier has indicated that this type of operation is possible if it is set up using large storage receiver capacity. A large storage (1,060 gallon) receiver should be installed to accomplish efficient control and act as a buffer to store nitrogen during off hours.

A storage receiver of this size, operating with a 30 psi pressure band reserve, would contain about 9.5 minutes of capacity at 30 cfm demand (the capacity of one nitrogen bank). This would be more than enough storage to ride out the worst-case 3-minute delay that occurs when a nitrogen bank comes out of standby.

Control of the new nitrogen generators will be important to maintain system efficiency. A system of coordination will need to be set up to ensure that only the necessary numbers of banks are online at any one time. This will reduce the 70 to 80 cfm of air that is currently being wasted purging a bank that is producing near zero flow. The addition of large system storage downstream of the nitrogen generators would enable the generators to be switched on and off as required and still have enough nitrogen in reserve to maintain a constant output pressure during the time delay on generator startup.

An enhancement of this control could be to install motor-operated valves, either centrally located or on each machine, so that the nitrogen demand can be reduced as low as possible during non-production hours to limit the number of times the system must start to top up the pressure. The same could be done with the air system, with a valve installed to allow the plant compressed air to be turned off at night or on weekends when not required, eliminating the need to supply air to leaks.

Further enhancement of the nitrogen system would regulate the nitrogen pressure to as low a level as possible to minimize the impact on local machine flow adjustment through varying conditions. Installation of the local flow meters in a different manner would also maintain accuracy of the flow and allow local operations to minimize the nitrogen demand.

The production machinery's nitrogen metering system, using flow meters and a manual metering adjustment valve, is very sensitive to pressure changes. More accurate flows could be gained by regulating the nitrogen pressure to a constant lower level. Measuring the flow at this high pressure would also be more accurate because the flow metering used is sensitive to pressure changes.

New Air Compressor for Higher-Peak Flows and Backup

Presently, the total peak facility airflow during the transient events reaches an estimated 640 cfm, including the nitrogen system. This is near the total capacity of the installed compressors and allows the plant pressure to drop to lower levels during transient peaks when the two systems are not tied together. A reliable system should have enough capacity in automatic-start backup service to provide this flow, plus be able to withstand the loss of the largest compressor with no deficit in capacity during the hottest day of the year (when the compressors produce the least).

At proposed flows, with a new nitrogen system and air dryer added causing peaks of 776 cfm, a new compressor will be required anyway to enable the system to operate without pressure loss during peak flows. If a new unit is to be purchased, it would be best to install a compressor larger than the existing 100 HP to give the system the capability of feeding peak flows with only two compressors running. If a 90 kW unit is installed, the peak flows could be supplied using either of the existing compressors and, during average flows, only the 90 kW unit would be required.

CURRENT COMPRESSED AIR SYSTEM	CURRENT kWH	CURRENT $ COST	PROPOSED kWH	PROPOSED $ COST
Main Air System	447,811	$23,487	440,882	$33,664
Nitrogen System	777,993	$42,462	Above	Above
Total	**1,225,804**	**$65,949**	**440,882**	**$33,664**

Financials and Conclusion

The capital required to effect the proposed changes to the compressed air and nitrogen generation systems is $265,896. Original plans to upgrade the system would have cost $84,091. The incremental cost for the energy efficiency measures is therefore $181,805. The annual energy savings resulting from the proposed changes are estimated at $33,664 which represents almost a 50% reduction in energy costs. What is very interesting is these savings are accomplished while increasing the peak air flow capacity and nitrogen generating capability required by the increased nitrogen requirements. With $98,000 in Manitoba Hydro Power Smart incentive (Performance Optimization Program) and $28,800 in additional incentives from the Office of Energy Efficiency ecoEnergy Retrofit program (federal). The simple ROI of the project is 1.7 years.

This project again illustrates the value of a system assessment. In this situation, the decision made by the snack food manufacturer to enable all bagging machines to use nitrogen had management expecting higher associated energy costs. On the contrary, the company was able to reduce their energy costs significantly by implementing the actions detailed in the assessment. BP

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For more information please contact Ron Marshall, CET, CIM, Industrial Systems Officer, Business Engineering Services, Manitoba Hydro, tel: 204-360-3658, email: rcmarshall@hydro.mb.ca

THE PNEUMATIC ADVANTAGE

Washdown Pneumatics Help Evergreen Packaging Avoid Contamination, Reduce Downtime

BY KJELL LYNGSTAD, BOSCH REXROTH PNEUMATICS

Cleanliness is often considered a virtue. In the beverage packaging industry, however, cleanliness is an absolute necessity. For one particular beverage and juice packaging equipment manufacturer, Bosch Rexroth, pneumatics provides the ideal solution to avoid contamination, reduce downtime and maintenance costs and, ultimately, increase production.

Small Footprint, Big Performance

Evergreen Packaging of Cedar Rapids, IA (www.evergreenpackaging.com) is considered to be one of the most reliable beverage packaging equipment companies in the industry, meeting demand for almost every size and speed the beverage packaging market requires. The company recently developed an economical and easy-to-operate gravity-fill bottle filler that utilizes washdown pneumatic valves from Lexington, KY-based Bosch Rexroth (www.boschrexroth-us.com/BRP). Ideal for water, juice, dairy and other still beverage products, the Evergreen BFCG-32/16 provides high production output and the versatility to handle a variety of liquid food products at a 95% or higher efficiency rate.

Using 32 fill heads and 16 capping heads, the small-footprint rotary machine takes up only 47.5 sq/ft. and can fill up to 400 bottles-per-minute (bpm). Externally demountable, the no-drip fill nozzles require a minimal amount of pressure to actuate, dramatically reducing bottle wrinkling and product waste. Air consumption is 3.6 CFM at 85 psig.

The machine can handle PET, HDPE, LDPE, PP and glass bottles. With a special focus on cleanliness, Evergreen offers extended-life options including HEPA, auto sanitize and full clean-in-place (CIP) capabilities. The auto-sanitize feature periodically sprays sanitizing solution on critical product contact surfaces to further protect against product contamination.

Evergreen Packaging's bottle filler emphasizes high production in a small footprint with full CIP capability, including pneumatic washdown valves from Rexroth.

THE PNEUMATIC ADVANTAGE

Washdown Pneumatics Help Evergreen Packaging Avoid Contamination, Reduce Downtime

Challenge

Provide washdown pneumatics for Evergreen Packaging bottle filler

Bosch Rexroth Solution

- CL03 Clean Line washdown valves
- AS-Series air-preparation system

Benefits

- IP69K washdown-rated valves
- Lower maintenance, improved uptime
- Sanitary-design valves with smooth corners and drainable surfaces to avoid build-up
- Fiberglass-reinforced polyamide and stainless steel hardware resists chemicals used in the washdown process
- Eliminates need/cost for dedicated stainless steel cabinets
- Valves mounted closer to actuators reduce material costs, lower energy consumption and improve cycle time
- All air-prep functions combined in one modular/flexible package

Rexroth Washdown Pneumatics Prevent Contamination, Provide Cost Advantages

In the dairy and juice industries, machines are washed down constantly to avoid contamination. Equipment is subjected not only to water, but is also exposed to chemical cleaners and sodium potassium hydroxide.

Using pneumatics for washdown applications in the beverage industry is an advantage because of low maintenance costs and reduced downtime.

Because of its minimal risk of contamination, pneumatics is a very clean technology and the first choice for food and packaging companies such as Evergreen. Pneumatic products are also able to withstand even the toughest environments, with a longer life expectancy due to their simple design and limited number of internal components.

To help avoid contamination and reduce downtime and maintenance costs, Evergreen utilizes IP69K washdown-rated CL03 pneumatic valves from Bosch Rexroth. The valves are used to control the filling process and the integrated sanitation and clean-in-place system.

In order to meet the IP69K rating, the valves have to withstand high-temperature water with 1,450 psi pressure at a distance of four to six inches, while being rotated between 0-, 30-, 60- and 90-degree angles.

Bosch Rexroth designed the CL03 in cooperation with leading food and packaging end users and OEMs in both Europe and the United States. The company considered hygiene and other industry needs when producing this specially designed product that contains smooth corners and drainable surfaces with no aluminum materials in exposed surfaces, strong fiberglass-reinforced polyamide 12, stainless steel hardware, positive joints to avoid material build-up, HNBR seals between the valve cover sub-base and sub-plates and a host of other features.

In addition to lowering the need for maintenance, CL03 valves also provide productivity, cost and energy advantages. No stainless steel cabinets are needed to house the valves, while the ability to mount the valves closer to the actuators minimizes the lengths of the air lines, resulting in reduced air-consumption costs. Placing the valves closer to the actuators also reduces cycle time, which improves productivity.

In addition, Evergreen is using the Rexroth AS-Series air-preparation system, which combines a modern, clean design with high modularity and complete flexibility. Using the AS-Series, Evergreen can combine all air-preparation functions in one package. With superior pressure control characteristics, the AS-Series air-preparation system ensures long-term process consistency.

Tim Hughes, director of engineering at Evergreen, says using pneumatics, particularly for washdown and sanitary food applications, is an advantage because of the associated low maintenance costs and reduced downtime.

"In the dairy and juice industry, you can't afford to have downtime on a production line," said Hughes. "Stores get milk shipments every day, so avoiding downtime is absolutely critical. In addition, dairies survive on very low margins. If they have high maintenance costs for keeping a piece of equipment going, that comes out of the profit margin. The beauty of pneumatics is that they're easy to troubleshoot and detect problems, without downtime being an issue," he said.

For companies such as Evergreen, Bosch Rexroth offers the ideal solution. "The beverage environment is a washdown environment," said Hughes. "There are a lot of valve companies in the industry that claim to have IP65 products, but our experience has been that the IP65 components really don't work as well as the manufacturers believe they do. With the CL03 from Bosch Rexroth, the design is actually IP69K, which is extremely watertight. All the surfaces are either plastic or stainless steel, so you don't get any corrosion from cleaning chemicals, compared to other valves that use aluminum or some lesser metals that would corrode."

Hughes points out the importance of getting products from a company like Bosch Rexroth, which has a good reputation in the industry. "Someone can come in the door with a great valve, but if it's a company you've never heard of before, that's a risky thing to do," he says. BP

Designed with input from several leading food processors and OEMs, Rexroth's CL03 pneumatic valves are IP69K rated and can withstand high-temperature 1,450 psi washdown.

For more information, please contact Kjell Lyngstad, Manager, Industrial Markets & Applications — Pneumatics, Bosch Rexroth Corporation
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www.evergreenpackaging.com

The AS-Series air-preparation system combines all air-preparation functions in one package. Its superior pressure-control characteristics ensure long-term process consistency for Evergreen Packaging.

THE TECHNOLOGY PROVIDER

Carbon Zero Air Compressors

BY COMPRESSED AIR BEST PRACTICES®

Compressed Air Best Practices® spoke with Peter Kyriacopoulos, General Manager/VP, USA Region East, for Atlas Copco Compressors.

Good afternoon. What is a "carbon zero" air compressor?

A "carbon zero" air compressor has a net energy consumption equaling zero. The installation and operation of a "carbon zero" air compressor gives users the ability to recover the energy used in compressing air, meaning "net zero" energy consumption in the facility. The net CO_2 greenhouse gas footprint, therefore, is also zero. Hence the name of "carbon zero" air compressors.

Our customers are driven to improve the sustainability of their operations. Reducing their carbon dioxide emissions is a high priority for them and reducing their energy use is an important tactic in meeting their goals. While compressed air systems account for an average of approximately 10% of all industrial electricity consumption, compressed air costs can be as high as 40% of a plant's electricity bill.

A 700 kW Atlas Copco Carbon Zero Air Compressor.

How can an air compressor consume "net zero" power?

In the simplest terms, the electrical power required to run a water-cooled air compressor can be recovered in the form of hot water to be used in another process. Atlas Copco's Oil-Free Air Division has taken this "heat recovery" philosophy and integrated it into the company's ZR Series of water-cooled, oil-free air compressors.

Hot water or steam is normally generated using industrial boilers that consume electricity or fuels like heating oil or natural gas. When using hot water from the compressor, either directly or as preheated boiler-feed water, the consumption of fuel can be either dramatically reduced or eliminated. This results in significant energy savings.

TÜV tested the net energy consumption?

Yes. While our R&D efforts had confirmed the results, we felt it was important to receive third-party verification of this important advancement.

The independent Technische Überwachungs-Verein (German Technical Monitoring Association or "TÜV") therefore supervised the type-testing of Atlas Copco's ZR 55-750 kW water-cooled, oil-free screw compressors, equipped with built-in energy recovery systems.

The testing process involved real-time measurement of the electrical power input and the output power as hot water. The two measurements were then compared. It was proven that under the specific design conditions of 104 °F and 70% percent relative humidity, 100% of the input electrical power could be recovered in the form of hot water.

The test results demonstrate that the ZR Series oil-free air compressors, with built-in energy recovery systems, are the first in the world to be TÜV certified for net zero energy consumption. In specific design conditions, 100% of the electrical power needed to run an Atlas Copco ZR 55-750 kW water-cooled, (up to 900 kW VSD) oil-free screw compressor can be recovered in the form of hot water.

"Atlas Copco's continuous investments in innovation are more important than ever in these difficult times, in both supporting our customers in improving productivity and reducing energy costs."

— Ronnie Leten, President and CEO, Atlas Copco Group

THE TECHNOLOGY PROVIDER

Carbon Zero Air Compressors

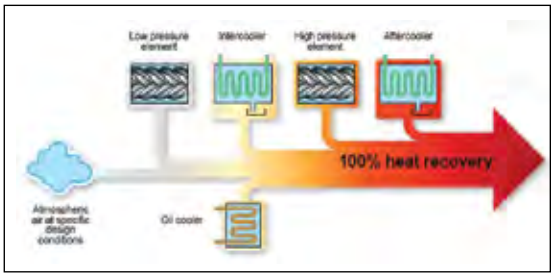

Image courtesy of Atlas Copco.


Certificate

ET 314 2008 C2

Under the supervision of TÜV Rheinland the company

Atlas Copco Airpower n.v.
Oil-free division
Boomsesteenweg 957
B-2610 Wilrijk (Belgium)

made a type test of the
oil free screw compressor series ZR 55 – 750, equipped with built-in energy recovery systems.
The aim was to compare the electric energy consumption with the heat energy recovered

Results:

The tests demonstrated that 100% of the electric energy consumed by the compressors could be recovered by the built-in Atlas Copco energy recovery systems, when working at specific design conditions (see below) and an outlet pressure of 10 bar(e) / 145 psig.

Based on the results and the calculations it can be confirmed that the net power (energy) consumption of the ZR compressors with built-in energy recovery at specific design conditions is zero.

For detailed results see page 2 of the certificate and test report no. ET-314-2008-I-1.

This certificate is valid until 31.12.2011.

Test Centre for Energy Technology

Certificate ET 314 2008 C2 Page 1/ 2

TÜV has certified the Carbon Zero Air Compressors.

What industries/applications can take advantage of the hot water and steam?

Most industries can make use of hot water for space heating and showers. However, the industries that will benefit the most are those that have a continuous need for hot water and steam in their processes. Typical process hot water and steam users include:

- Food and milk processing plants (for scalding, cleaning, sterilization and melting)
- Pulp and paper industry (in the digester and evaporators and in bleaching and pulping)
- Textile industry (for dyeing and stabilization of manmade fibers)
- Pharmaceutical industry (for fermentation and sterilization)
- Refineries, chemical and petrochemical plants (for steam distillation, enhanced recovery, stripping and heat tracing)
- Power plants (for electricity generation)
- Clean rooms (for humidification)

Please describe how this "heat recovery" feature functions in the air compressor.

When an Atlas Copco carbon zero compressor compresses air, the input electrical energy is converted into heat. This heat appears at the low-pressure and high-pressure compression elements, the oil cooler, intercooler and aftercooler. The built-in energy recovery system circulates cooling water through all of these components and, as a result of the heat transfer, yields hot water at up to 90 °C (194 °F). The efficient coolers also help to collect the heat energy in the incoming air (through latent heat of condensation).

Here is a more specific example of where the heat is recovered within the air compressor. A carbon zero compressor working at 145 psig with inlet water temperature of 68 °F will recover the heat as follows:

Oil cooler	12%
Compression elements	9%
Intercooler	37%
Aftercooler	42%

What happens to heat recovery under different operating conditions?

At higher temperatures (more than 104 °F) and higher relative humidity (70%) it is even possible to recover more than 100% of the electrical energy input. In the average manufacturing environment, with lower temperatures and relative humidity, the recovery will amount to 90–95%.

How is the carbon zero compressor different than a standard Z Series air compressor?

In the standard Z Series compressor, efforts are taken to reduce outlet water temperatures so that they average 120–130 °F at the outlet. Most customers don't want the outlet water to be too hot (if they aren't going to use it)!

The Carbon Zero air compressor deploys an engineered modification to how we route the water through the air compressor. Mechanical control components have been added as well as modified water circuits.

What do the returns-on-investment look like?

This is the exciting part. Not only does the carbon zero air compressor provide a "win" to the sustainability efforts of the user, the ROIs are so compelling that they also provide a "win" to the facility's bottom line.

A 750 kW (1000 horsepower) carbon zero compressor, for example, can save a facility $320,000 per year in costs previously generated by the heating oil used for boiler feed water. This example assumes a boiler efficiency of 90%, a cost of $2.00 per gallon of heating oil, consumption of 20 gallons per hour of fuel and 8000 working hours per year.

For this facility size, the investment required would be less than $50,000 for the heat recovery module, plus $50,000–$75,000 for a pumping skid to deliver the hot water to its destination. The customer's return-on-investment, in this conservative scenario, is less than six months.

Thank you for your insights. BP

For more information please contact Peter Kyriacopoulos, Atlas Copco Compressors, tel: 518-573-9716, email: peter.kyriacopoulos@us.atlascopco.com, www.carbonzerocompressors.com

AIR STANDARDS

A Discussion on Air Quality Standards ISO 8573.1 and ISO 12500

BY JAY FRANCIS, VICE PRESIDENT OF MARKETING, SPX DEHYDRATION & FILTRATION

SPX Dehydration & Filtration's new filter is designed to Meet ISO 8573.1 and ISO 12500 standards.

The next time you sit down for dinner, take a good look at your food. There's a very good chance compressed air played an essential role in preparing your meal for consumption.

Compressed air is a vital energy source and is utilized in multiple operations in food processing facilities. When properly treated, compressed air is regarded as a safe, clean utility as compared to other energy sources. Compressed air provides the energy source for pneumatic conveyers that transport liquids, powders and moisture-sensitive product throughout the plant. It provides power for pneumatically operated tools and equipment that renders meat products, aerates liquids and mixes granular ingredients. It is ultimately used to package, wrap, seal, palletize and label food products prior to storage or shipment.

Of the primary utilities employed in the food-manufacturing environment, compressed air is the only utility generated by the end user. This means the end user directly influences the quality of this energy source. High-quality compressed air is critical for providing food products that are not only cost effective to process, but also safe to eat. Therefore, it's in all of our best interests for food processors to select the proper compressed air equipment. The ISO 8573 air quality standards and ISO 12500 compressed air filter standards make the basis for air-treatment product selection much easier.

A Very Good Start — ISO 8573.1

Food processors maintain a social responsibility to uphold the quality of their products, and that accountability begins with the selection of compressed air system components. In most cases, end users select compressed air system components by comparing technical data from various air treatment manufacturers. In 1991, the International Standards Organization (ISO) established the 8573 compressed air quality standard to facilitate compressed air system component selection, design and measurement.

ISO 8573 is a multi-part standard, with Part 1 classifying contaminant type and assigning air-quality levels, and Parts 2 through 9 defining testing methods to accurately measure a full range of contaminants within the end-user's facility.

ISO 8573.1 identifies three primary contaminant types as prevalent in a compressed air system. Solid particulates, water and oil (in both aerosol and vapor form) are recognized. Each is categorized and assigned a quality class ranging from class 0, the most stringent, to Class 9, the most relaxed. The end user is responsible for defining the air quality required for his particular application or process. Air- treatment manufacturers present technical data in reference to ISO 8573.1. An easy to understand ISO 8573.1: 2001(E) table below defines the various air-quality classes. The standard also determines that air quality shall be designated by the following nomenclature:

Compressed Air Purity Classes A, B, C:
Where:
A = solid particle class designation
B = humidity and liquid water class designation
C = oil class designation

CLASS	SOLID PARTICLES, PARTICLE SIZE, d (mm)			HUMIDITY AND LIQUID WATER		OIL	
	0.10 < d ≤ 0.5	0.5 < d ≤ 1.0	1.0 < d ≤ 5.0	PRESSURE DEW POINT		TOTAL CONCENTRATION: AEROSOL, LIQUID AND VAPOR	
	MAXIMUM NUMBER OF PARTICLES PER m^3			°C	°F	mg/m^3	ppm/w/w
0	As Specified			As Specified		As Specified	
1	100	1	0	≤-70	-94	≤0.01	≤0.008
2	100,000	1,000	10	≤-40	-40	≤0.1	≤0.08
3	—	10,000	500	≤-20	-4	≤1	≤0.8
4	—	—	1,000	≤+3	38	≤5	≤4
5	—	—	20,000	≤+7	45		
6				≤+10	50		
				LIQUID WATER CONTENT Cw g/m^3			
7				Cw≤0.5			
8				0.5<Cw≤5			
9				5<Cw≤10			
PER ISO8573-1: 2001(E)							

AIR STANDARDS

A DISCUSSION ON AIR QUALITY STANDARDS ISO 8573.1 AND ISO 12500

More than you thought

Compressed Air Contamination

Contaminants originate from three general sources:

1. Contaminants in the surrounding ambient are drawn into the air system through the intake of the air compressor. Ingested contaminants appear in the form of water vapor, hydrocarbon vapors, natural particles and airborne particulates.

2. As result of the mechanical compression process, additional impurities may be introduced into the air system. Generated contaminants include compressor lubricant, wear particles and vaporized lubricant.

3. A compressed air system will contain built-in contamination. Piping distribution and air storage tanks, more prevalent in older systems, will have contaminant in the form of rust, pipe scale, mineral deposits and bacteria.

Water

Water vapor enters the system through the intake of the air compressor. In total volume, condensed water vapor represents the majority of liquid contamination in a compressed air system. On a typical summer day of 80 °F (21 °C) and 70% relative humidity, approximately 19.5 gallons (73.8 liters) of water enters a 100 scfm (170 nm³/hr) system in a 24-hour period. This moisture will spoil food products, cause pneumatic machinery failure and promote bacterial growth in the compressed air piping. Compressed air systems serving the food processing industry must maintain dry, moisture-free conditions to mitigate the risk of microorganism growth.

Since compressed air used in food processing operations may come in direct contact with the food, a compressed air dryer producing a sub-zero pressure dew point is required. Dew point, specified as temperature, is the point at which the water vapor held in the compressed air is equal to the compressed air's capacity to hold water vapor. Desiccant dryers — using activated alumina — will adsorb water vapor from the air most effectively, delivering ISO 8573.1 Quality Class 2 (-40 °F/-40 °C) pressure dew point, ideal for the food processing industry. At this level of dryness, bacteria will cease to grow.

GALLONS OF WATER ENTERING A SYSTEM PER DAY/100 SCFM (170 NM³/HR)									
TEMPERATURE OF AMBIENT AIR		% RELATIVE HUMIDITY							
°F	°C	20%	30%	40%	50%	60%	70%	80%	90%
120 °F	49 °C	18.6	27.9	37.2	46.5	55.8	65.1	74.4	83.7
110 °F	43 °C	14.1	21.0	27.9	35.1	42.0	48.9	55.8	63.0
100 °F	38 °C	10.5	15.6	20.7	26.1	31.2	36.6	41.7	46.8
90 °F	32 °C	7.8	11.4	15.3	19.2	23.1	26.7	30.6	34.5
80 °F	27 °C	5.7	8.4	11.1	13.8	16.8	19.5	22.2	24.9
70 °F	21 °C	3.9	6.0	7.8	9.9	12.0	13.8	15.9	18.0

Liquid Oil and Oil Vapor

The most scrutinized and often discussed contaminant classified by ISO 8573.1 is oil. Compressed air "free from oil" is a requirement in a food-processing environment.

End users are given the choice of selecting from several air compressor technologies, some of which require lubrication in the compression chamber for cooling and sealing purposes, and others that operate less lubricant in the compression chamber. The end user determines which compressor design best meets the desired requirements. The purpose of this discussion is not to tip the scale toward either technology, but to address air treatment requirements in food processing applications.

Lubricated compressors are typically less expensive to purchase and have a lower cost of ownership. Dependent on the age of the compressor and preventative maintenance programs performed, a lubricated rotary-screw air compressor will introduce 2 to 10 ppm/w of oil into the air system. A well maintained 250 scfm lubricated air compressor, with a conservative 4 parts per million carry-over, will add up to 4.8 gallons (18.2 liters) of oil into the air system over an 8000-hour operation.

Lubricant-free compressors generally have a higher initial cost and greater maintenance costs over the life cycle of the equipment. Lubricant is only required for the bearings and timing gears, which are segregated from the compression chamber. This compressor technology presents no risk of lubricant migrating into the process air.

Both air compressor technologies are subject to the inherent challenges presented by quality of the intake air. Ingested contamination in the form of water vapor, solid particulate and hydrocarbon vapor must be addressed, regardless if the compressor is lubricated or free from lubricant. Depending on the location of the compressor intake, oil vapor levels in industrial areas may contain 20–30 ppm of airborne hydrocarbon aerosols. Hydrocarbon vapors, the primary component of fossil fuel combustion, will condense in a piping system when cooled, forming a liquid contaminant.

COMPRESSED AIR

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Working Together for Compressed Air Best Practices

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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AIR STANDARDS

A DISCUSSION ON AIR QUALITY STANDARDS ISO 8573.1 AND ISO 12500

Because compressed air may come in direct and indirect contact with food processing, an elevated level of filtration is required. A high-efficiency coalescing filter capable of removing solids and liquids is recommended. It should be capable of removing solid and liquid aerosols 0.01 micron and larger. The remaining oil content should be 0.007 ppm or less. An activated carbon filter, installed in series, is also recommended downstream of the coalescing filter. The adsorption filter will remove trace odors and oil vapor to 0.003 parts per million by weight. This filter combination will ensure specified filtration levels achieve ISO 8573.1 Class 1 for oil and vapor removal.

		GALLONS OF OIL ENTERING A SYSTEM PER YEAR			
CONCENTRATION PPM_w	TIME (HOURS)	25 HP (19kW) 100 SCFM	50 HP (37kW) 250 SCFM	100 HP (75kW) 500 SCFM	200 HP (149kW) 1000 SCFM
2	2000	0.2	0.5	1.2	2.4
	4000	0.5	1.0	2.4	4.8
	8000	1.0	1.9	4.8	9.6
4	2000	0.5	1.2	2.4	4.8
	4000	1.0	2.4	4.8	9.6
	8000	1.9	4.8	9.6	19.2
6	2000	0.7	1.8	3.6	7.2
	4000	1.4	3.6	7.2	14.4
	8000	2.9	7.2	14.4	28.8
8	2000	1.0	2.4	4.8	9.6
	4000	1.9	4.8	9.6	19.2
	8000	3.8	9.6	19.2	38.4
10	2000	1.2	2.9	6.0	12.0
	4000	2.4	5.8	12.0	24.0
	8000	4.8	11.6	24.0	48.0

Solid Particles

In a general industrial area, there are nearly 4,000,000 airborne particles per cubic foot of air. When this ambient air is compressed to 100 psig, the concentration of solid contamination will reach significant proportions. Most air compressor intake filters are rated to capture solid particles 4 to 10 microns in size and larger and are rated at 90–95% efficiency. Approximately 80% of airborne particles are 10 micron or less. Spores, pollen and bacteria are less than 2 microns in size. This may seem like a lot of particulate matter, but keep in mind, a solid particle 40 um in size is barely visible to the naked eye. Even a well-maintained and routinely changed intake filter will allow solid particles to enter the air system.

Solid particulate must be removed from process air serving the food industry. In pneumatic control circuits, solids particles plug control valve orifices, effect accuracy of gauging and score air cylinders walls, causing leaks. Particles may restrict flow through air jet nozzles used to clean food-preparation surfaces or adversely affect the consistency of spray coatings applied on food products.

To achieve the recommended ISO 8573.1 Class 2 classification for solid particulate removal, a 1.0 micron particulate filter is recommended. The particulate filter will also enhance the service life of high-performance coalescing filters by minimizing solid loading.

RELATIVE MICRON SIZES	
CONTAMINANT	SIZE (UM)
Tobacco smoke	0.5
Cement dust	1.0
Atmospheric dust	5.0
Fertilizer	10.0
Barely visible to the eye	40.0
Human hair	70.0
Grain of table salt	100.0

Meeting the Newest Challenge — ISO 12500

The ISO 8573 air quality standard is serving the industry well by raising end-user awareness of how to measure and define the quality of compressed air. Using this, the end-user can make educated decisions as to the filtration performance required to generate a certain quality level. However, this standard does not address how manufacturers are to test and rate the filters. The playing field is not level and consumers become confused. The ISO 12500 filter standard addresses this issue and establishes how manufacturers test and rate compressed air filters.

The standard defines critical performance parameters (namely, inlet oil challenge, inlet compressed air temperature and pressure measurement techniques) that will deliver certifiable filter performance information suitable for comparative purposes.

ISO 12500 is a multi-part standard, with ISO 12500-1 encompassing the testing of coalescing filters for oil aerosol removal performance, ISO 12500-2 quantifying vapor removal capacity of adsorption filters and ISO 12500-3 outlining requirements to test particulate filters for solid-contaminant removal.

The SPX Dehydration and Filtration Research and Development center, located in Canonsburg, Pennsylvania, maintains advanced testing resources to conduct ISO 12500-1, -2 and -3 filter testing. Three separate test laboratories were constructed, each equipped with stainless steel piping, state-of-the-art instrumentation and contaminant measurement equipment. SPX D & F maintains capabilities to generate dehydrate and filter-compressed air through 3000 scfm.

Test Methods

The following describes methods SPX Dehydration and Filtration has elected to perform filter-performance testing under the guise of ISO 12500 standards.

ISO 12500-1:2007 — Filters for Compressed Air — Part 1: Oil Aerosols

ISO 12500-1 has identified two opposing inlet oil aerosols concentrations to determine the performance and pressure drop characteristics of coalescing filters. The inlet concentrations, 10 mg/m³ and 40 mg/m³, were selected to provide a wide-challenge variance. Filter manufacturers may elect to publish performance data at either one of the two inlet concentrations. The challenge concentration selected shall appear in published technical data.

Note: 1 mg/m³ = 0.84 ppm by weight

a) The ISO 12500-1 coalescing filter test begins with a clean, reliable source of compressed air.

b) Testing conditions shall be controlled: inlet air pressure = 101.5 psig (7 bar), inlet air temperature = 68 °F (20 °C) and ambient temperature = 68 °F (20 °C).

c) An initial (dry) pressure drop measurement is taken. Initial pressure-drop ratings are relevant to quantify cost of operation in that condition.

d) A Laskin nozzle generator develops a supply of aerosols with a peak distribution profile of 0.1 to 0.3 microns in size. Aerosols in this range are the most difficult to remove. These oil aerosols are injected into the clean compressed air stream.

e) A white light scattering photometer measures the upstream concentration to ensure the mixture complies with the 10mg/m³ or 40mg/m³ aerosol challenge.

f) Air then enters the coalescing type filter.

g) Once the filter reaches equilibrium, often referred to as the "wetted condition", measurements are taken to determine the effectiveness of the filter. A white light scattering photometer is used to measure the penetration of the oil aerosols through the coalescing element. The pressure drop across the filter housing is also measured and recorded.

h) Three sets readings are taken. The manufacturer publishes the average performance value derived from the three tests.

i) At the given inlet concentration of oil, the ISO 12500-1 test will confirm:

- Oil aerosol penetration expressed as mass per unit volume (mg/m³)
- Oil aerosol filtration efficiency expressed in percent (% captured)
- Pressure drop (°p)

The SPX Dehydration & Filtration Separate Test Booths for ISO 12500 Parts 1-3.

Mark Honath, Senior Engineer, Research & Development, SPX Dehydration & Filtration, demonstrates the SMPS (Scanning Mobility Particle Sizer) System within the ISO 12500 Part 3 Test Lab.

AIR STANDARDS

A DISCUSSION ON AIR QUALITY STANDARDS ISO 8573.1 AND ISO 12500

ISO 12500-2:2007 — Filters for Compressed Air — Part 2: Oil Vapors

ISO 12500-2 determines the adsorption capacity and pressure drop of hydrocarbon vapor-removal filters. Adsorption filters, utilizing an activated carbon medium, possess the polarity to attract hydrocarbon vapors from an air stream onto a porous surface. The adsorption process will continue until the activated carbon media is fully consumed. A mass measurement is taken confirming the vapor-removal filter's adsorptive capacity, expressed in milligrams of hydrocarbon adsorbed.

a) The ISO 12500-2 adsorption filter test begins with a clean, reliable source of compressed air.

b) Testing conditions shall be controlled: inlet air pressure = 101.5 psig (7 bar), inlet air temperature = 68 °F (20 °C) and ambient temperature = 68 °F (20 °C).

c) A precision rotameter measures the concentration of n-hexane liquid. N-hexane is widely used in laboratory testing for hydrocarbon measurement and possesses the properties required to conduct adsorption filter testing (i.e. easy to evaporate, colorless, light distinguishable odor and easy to measure.)

d) A heater vaporizes the n-hexane liquid at 155.6 °F (68 °C). When heated, n-hexane changes phase and turns into a vapor.

e) The vapor-enriched air is injected and mixed with the clean air source.

f) The mixture of air and n-hexane vapor enters the adsorption filter. An initial (dry) pressure drop measurement is taken. Note: Adsorption filters are designed to remove vapor and not liquid contaminants. Establishing a dry pressure drop is useful to determine cost of operation.

g) An infrared spectrometer is used to detect the presence of n-hexane vapor at the filter outlet.

h) The filter is continually monitored until vapor penetrates through the adsorptive filter element. Breakthrough indicates the filter is fully consumed and is incapable of adsorbing additional vapor.

i) An adsorptive capacity value (total amount adsorbed) is established in milligrams.

j) Three filters of the same size shall be tested under identical conditions. The manufacturer publishes the average performance value derived from the three tests.

ISO 12500-3:2009 — Filters for Compressed Air — Part 3: Particulates

Note: One micron particle measures 0.000039 of an inch.

ISO 12500-3 provides guidance for the testing and methods for determining particulate filter removal efficiency by particle size. Filters shall be challenged by solid particulate in the range 0.01<5.0 um for fine type filters and particulate of 5.0>40 um for course type filters.

a) The ISO 12500-3 particulate filter test begins with a clean, reliable source of compressed air.

b) Testing conditions shall be controlled: inlet air pressure = 101.5 psig (7 bar), inlet air temperature = 68 °F (20 °C) and ambient temperature = 68 °F (20 °C).

c) Initial pressure-drop measurements across the filter housing are taken and recorded.

d) To generate solid particles for the test, a salt solution is atomized and then dried, forming salt particles ranging from 0.050 to 0.1 microns in size.

e) These particles are then injected into the clean air stream.

f) A Scanning Mobility Particle Sizer (SMPS) provides high-resolution counting of particles by size and plots a distribution curve for the filter inlet challenge.

g) The SMPS is also used to measure the particle distribution downstream of the filter, thus determining the filter's penetration characteristics.

h) Filter efficiency, by particle size, can be calculated and expressed in percent (%).

i) Three filters of the same size shall be tested under identical conditions. The manufacturer publishes the average performance values derived from the three tests.

Complimenting Each Other

The ISO 8573 standard will continue to benefit end users by defining air quality levels and methods to determine contaminants present in their air system. The ISO 12500 test standards will benefit air treatment manufacturers by providing the means to commercially separate filter products through certifiable performance. We all benefit by appreciating that ISO, a global international standards organization, continues to refine its standards for the betterment of the compressed air industry and private sector. BP

For more information please contact Jay Francis, Vice President of Marketing, SPX Dehydration & Filtration at jay.francis@spx.com.

SEVEN SUSTAINABILITY PROJECTS FOR INDUSTRIAL ENERGY SAVINGS

The New Trend in Outdoor Area Lighting

BY TED STOUCH, PRESIDENT/CEO, STOUCH LIGHTING

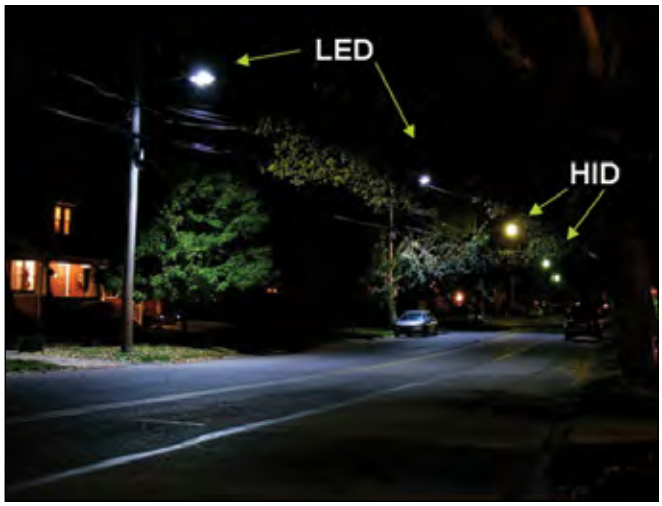
Overview

Outdoor area lighting can be defined as lighting for streets, roadways, parking lots and pedestrian walkways. These applications have traditionally been serviced with conventional lighting technologies such as high-intensity discharge (HID) lamps and fixtures. HID lighting has been utilized for many years in outdoor area lighting applications and has well-documented performance attributes. Today's advancements in Light Emitting Diode (LED) technology, however, have resulted in new alternatives for outdoor area lighting, which have several advantages over existing conventional lighting.

Seven Key Sustainability Projects

1. Metering
2. Demand Control
3. HVAC Optimization
4. Compressed Air
5. Lighting
6. Heat Recovery
7. Project Implementation and Funding

SEVEN SUSTAINABILITY PROJECTS FOR INDUSTRIAL ENERGY SAVINGS



Unlike conventional HID lighting, LEDs do not have a filament to burn out or break, making them extremely durable. Instead, a very small semiconductor chip runs electric current through the diode, which in turn drastically increases the longevity of the light source. Because there are no filaments to heat up, LEDs are "instant on". This makes them convenient for use in applications that are subject to frequent or potential on/off cycling, as well as circumstances where motion detectors are used. LED product quality can differ amongst manufacturers. Therefore, when choosing LED lighting, due diligence should be applied for an appropriate selection in achieving the best lighting quality and greatest energy efficiency for the associated cost. Furthermore, it is difficult to acquire long-term data and testing results as LED lighting rapidly evolves with technological advancements, meaning existing data is often deemed as obsolete. Interested users should research and compare manufacturers' technical data and information on various LED products, performances, qualities and lifetimes.

Well-designed LED outdoor luminaires can provide the required surface illuminance while consuming less energy and improving lighting quality and uniformity. LED luminaires also have significantly longer rated life (50,000 hours or more, compared to 15,000 to 35,000 hours of conventional HID lighting) and drastically lower maintenance costs. LED environmental benefits include: no mercury content, lead or other known hazardous materials that are often associated with conventional outdoor area lighting and less power usage necessary to distribute more light.

Design and Specification Considerations

Several dynamics go into the design and specification requirements for outdoor area lighting. Energy efficiency is a priority in these applications due to the long operating hours and comparatively high wattages that are typically associated with conventional lighting. The essential deciding factors that are linked to the overall quality of the lighting fixtures are: energy efficiency, durability, color quality, longevity, maintenance, light distribution and pollution, as well as initial costs.

Environmental and Energy Efficient Qualities

As previously stated, LEDs contain no mercury, lead or hazardous materials. The reduction in energy consumption also decreases the carbon emissions associated with powering existing conventional lighting. These environmental benefits also include the elimination of any costs associated with proper disposal at the end of an LEDs useful life. Although LEDs require less energy to operate, they often have a higher initial cost than HID lighting. Energy and cost savings that correlate with the use of LED outdoor area lighting has been estimated to be approximately 50–80%, depending on the LED product line, when compared to conventional HID lighting.

A municipality in Ellwood City, Allegheny County, Pennsylvania converted their HID street lights to Appalachian Lighting System's LED street lights. The municipality immediately recognized considerable cost savings. The existing wattage was reduced from 205W with HID lighting (including ballast) to 66W with LED lighting. Reduction increases an additional 75% between 2 am and dawn because of scheduled power down during off-peak hours. In addition, light levels increased due to the lack of lumen depreciation that occurs with conventional HID fixture(s). The municipality realized an 80% decrease in wattage and saw their annual budget for utility expenses decrease from $86,000 a year to $8,000 a year.

Below is a chart illustrating the comparison between the HID lighting and LED lighting:

	HID	LED
Wattage	295	70-94
Energy cost 5000 hrs/yr @ $0.10/kwh	$147.50	$35-$45
# of Lamps	1	LED Board
# of Ballasts	1	N/A
Lamp Life	2-3 years	20+ years
Ballast Life	4-5 years	N/A
Lamp Cost	$18.50	N/A
Ballast Cost	$65.00	N/A
Disposal Cost	Yes	No
Mercury Content	Yes	No
Instant On/Off	No	Yes
CO2 Emission	.43 Lbs/hr	.11-.14 Lbs/hr

Please Note:

- Chart is based on single street light fixture
- Information was taken from the retrofit before and after fixtures used in Ellwood City, PA

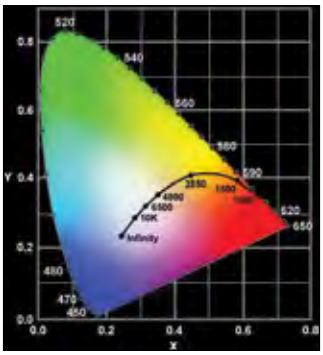
Color

The light emitted by LEDs provides an accurate rendering of an object's natural color. LED outdoor area lights have been designed to produce a cool, white light that ranges from 85 to 90 (on a scale of 100) on the color rendering index (CRI). Compared to conventional HID lighting, there is a 20% improvement in an observer's ability to discern color difference in objects. The most efficient white LEDs at this time emit light between 4500K to 6500K correlated color temperatures (CCT). This renders the light from white to bluish-white in appearance. Some LED luminaire manufacturers mix LEDs of various color temperatures to reach a target CCT for the array or luminaire, balancing the highest efficacy sources with warmer LEDs. Color rendering varies according to the make, model and CCT of the LEDs. The color index and temperature produced is also beneficial for security lighting. LEDs produce a direct point of light with the ability to adjust to the target area. There is often no glare or blurred images on security cameras as the light does not aim at the camera and, therefore, does not reflect off of the lens and distort the images.

Life and Lumen Maintenance

Estimating LED life can be challenging because of the long projected lifetimes that make full-life testing difficult. As LED technology continuously progresses, it often renders any past testing results as obsolete. Many LED manufacturers state lifetime expectancies of up to 100,000 hours (with less than 15 percent lumen depreciation over the 100,000 hours of operation). This is several times longer than the operating life of conventional lighting. Because many LEDs may last more than 10 years, the purchaser saves on the maintenance costs associated with replacing and relamping bulbs and fixtures on the regular cycle that occurs with conventional lighting. If the LEDs are driven at lower current and/or maintained at lower temperatures, useful life may be greatly increased. As a result, well-designed LED luminaires are less likely to fail suddenly than to depreciate slowly over time. Decrease in light output occurs in every form of lighting, whether it be LED or HID. The important factors are how much light depreciates, at what rate and how the light performs at the end of useful life.

Light Distribution and Glare



Light pollution is defined as light that is generated in excess of what is needed to reach lighting goals. Examples of light pollution include skyglow, light trespass and glare. Skyglow is caused by inadequately designed, unshielded and improperly aimed fixtures, creating a "dome" of wasted light that makes it difficult to see the night sky. Light trespass occurs when light is not aimed properly or shielded effectively and therefore spills onto areas that are not included in the lighting goals for a property. For example: a parking lot light from a shopping center illuminates a neighboring backyard. Glare is visual discomfort caused by excessive brightness, which often occurs in conventional outdoor area lighting because of the non-directional characteristics of the light source.

As America becomes more conscientious of the side effects and negative consequences of outdoor area lighting, we attempt to replace the orange glow of the cities and streets to the night skies that once existed. Academic studies performed over the last several years have contradicted the myth that "more light is better". When selecting lighting for outdoor area lighting, consider the use of LED lighting, but make sure to choose the correct LED lighting fixtures to properly direct light towards surfaces that are intended to be lit. This provides more effective use of the light and limits the light pollution often associated with conventional lighting.

SEVEN SUSTAINABILITY PROJECTS FOR INDUSTRIAL ENERGY SAVINGS

Street Light

Walkway Light

Parking Lot Light

Photo Credits: Appalachian Lighting Systems

LED luminaires use different optics than HID lighting. Each LED diode is, in effect, a direct point of light. Effective luminaire engineering utilizes the directional characteristics of LED light emission, in turn decreasing optical losses while increasing luminaire efficacy and providing more uniform light distribution across a targeted area. Improved surface lighting uniformity and higher levels of vertical illuminance are possible with LEDs and close-coupled optics.

Checklist for Choosing a Superior Outdoor Area Lighting

LED lighting technology is emerging to be a leading lighting source for outdoor area lighting applications. New products are being introduced and technology is advancing rapidly. As with all LED products, thorough informational planning and research is suggested to assess quality, performance and overall value. Follow the checklist below as a guideline to investigate the best high-quality LED lighting:

- Find out the warranty; 3 to 5 years is reasonable for outdoor luminaires. Be sure to read the fine print
- Retrieve operating temperature data and verify how this data relates to luminaire efficacy and lumen depreciation
- Appraise color temperature for suitability in the intended application
- Assess glare, preferably with the luminaire at intended mounting height and under typical nighttime viewing conditions, compared to the existing conventional lighting
- Evaluate the LED to HID lighting economic payback, based on wattage, energy use, maintenance savings, operating hours and operating costs for the application BP

For more information, please contact Ted Stouch, Stouch Lighting, tel: 866-964-8559, email: tstouch@stouchlighting.com, www.stouchlighting.com

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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**.

- **Compressed Air Users — Focus Industry**
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  - B. Audit case studies and "Best Practice" recommendations
- **Utility Providers & Air Auditors**
  - A. Utility Company Rebate Programs
  - B. Case Studies by Expert Compressed Air Auditors
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Bottling System Air Recovery & Sustainability at NPE2009

BY COMPRESSED AIR BEST PRACTICES®

The NPE2009 International Plastics Showcase was held June 22–26 in Chicago's McCormick Place. While attendance was down from NPE2006, the preliminary total visitor registrations numbered 44,000. Sustainability and energy efficiency were prominent topics in exhibitor booths and many manufacturers of compressed air and injection molding equipment showcased innovative sustainability initiatives.

As we experienced in the Compressed Air Best Practices® Magazine booth, the visitors were professionals from large, multi-factory companies who make plastic products (naturally!). They came from firms that deploy plastic extrusion and injection molding lines (using 100 psi systems) to create plastic products. The attendees also came from companies deploying stretch blow molding processes at 30–40 bar. We welcomed a record number of new subscribers from firms like Silgan Plastics Corporation, Ball Corporation and Graham Packaging, to name a few.

The Sidel SBO 34 Highspeed blows 61,200 small bottles per hour (from 0.2 to 0.7 L).

"Lightweighting" Plastic Bottles

When it comes to injection molding and blow molding, the plastics industry is changing quickly. Sustainability concerns raised by consumers is one of the main reasons why. Consumers are concerned about the volume of plastics used in plastic products and the solid waste that this generates. As a result, many food companies are "lightweighting" their product packaging. Some of the ramifications of lightweighting for compressed air systems are:

- ½ liter bottles are now being blown at 20 bar (vs. 40 bar) due to the reduced plastic content. This is now the norm for water bottles
- Carbonated soft drinks and juices in containers of less than 1 liter are using 30 bar air. CSD's in 2-liter and above containers are using compressed air in the 35 bar range

Renner Kompressoren announced their new partnership with Schrader. Pictured are Dave Lake (Schrader), Jan Lohoff (Renner) and David Jones (Schrader) (left to right).

Sidel Air Recovery Systems

We spoke with managers at Sidel Inc., one of the world's largest manufacturers of machinery used in bottling systems. As part of their sustainability strategy, Sidel has introduced an air recovery system to help blow molders reduce their energy costs associated with compressed air. As part of Sidel's larger options and upgrades initiatives to their global base of 27,000 machines, air recovery can reuse up to 40% of the compressed air expelled during bottle blow molding. This can result in a 15% overall drop in air consumption.

The Sidel Air Recovery System consists of an additional pneumatic circuit that recycles part of the exhaust air and then re-injects it into the machine's low-pressure blow molding circuit and into the plant's air supply network. The recovered air can be used to:

- Produce pre-blow air
- Produce service air for the blow wheel (stretching and nozzle cylinders)
- Supply the plant's compressed air network

The surplus recovery air is accessible at the foot of the machine and can be used for other plant air purposes. The air recovery system can be retrofitted onto existing machines and is being well received by Sidel's customers.

"As part of Sidel's larger options and upgrades initiatives to their global base of 27,000 machines, air recovery can reuse up to 40% of the compressed air expelled during bottle blow molding."

BOTTLING SYSTEM AIR RECOVERY & SUSTAINABILITY AT NPE2009

Atlas Copco displayed their Class Zero oil-free rotary screw compressors and introduced their free "walk-through surveys". Pictured are Paul Humphreys, Jack Maly and Francis Paradise of Atlas Copco (left to right).

Cameron introduced their new MAESTRO suite of programmable centrifugal compressor controls: Pictured is Kort Knous from Cameron.

We also learned that in Sidel's traditional Heat Resistant (HR) machine, up to 60% of the exhaust air can be collected and re-injected into the machine's low-pressure circuit. The upgrade involves a specific low-pressure panel where the recovery option is recorded into the process recipes and the installation of one recovery valve on each blowing station, activated by the PLC during the cooling phase.

Krones Air Recyling Package

Krones Inc. is a world leader in the manufacture of fully integrated packaging and bottling line systems. At their booth, we spoke with a manager about their Air Wizard air-recycling packages. Krones offers the Air Wizard 2 as a standard feature on their Contiform S blow molders. Much like Sidel's air recovery system, The Air Wizard 2 also allows exhaust air to be recaptured by a return valve with negative pressure. The air is recaptured at pressures between 118–176 psi.

Some of the highlights of the Air Wizard packages, referenced to a Contiform S16 with 25,600 containers an hour and 6,000 working hours a year, include:

- Compressed air savings: the reduction in the dead space involves downsizing the volume at the valve block and the blow nozzles, which for 0.5 liter bottles reduces the consumption of compressed air from 1,360 m³/h to a mere 1,017 m³/h
- Final blow-molding pressure reduction, resulting in compressed-air consumption for a 2.0 liter bottle of 1,812 m³/h instead of the previously consumed 2,455 m³/h
- Final blow-molding air recycling, which means that part of it can be used during the pressure-relief phase for pre-blowing and stretching. For a 2.5 liter bottle, this cuts the blow-molding air consumption from its previous 2,455 m³/h to a mere 2,198 m³/h
- It can reduce the previous consumption of stretching air (174 m³/h) to zero

Krones also introduced its new NitroHotfill Process, which it claims is the most cost-efficient option for PET hotfill applications. Process control is based on the newly developed "Relax-Cooling" (RC) concept, where the installation of a nitrogen-injection dosing feature just before the capper creates a positive pressure of 1.5 to 2 bar inside the bottle.

The positive bottle pressure compensates for the shrinkage in product volume downstream of the re-cooler, thus preventing any bottle deformation due to under-pressure.

This means the panel design previously required to compensate for the vacuum pressure with hot-filled products can be disposed of. The process can be utilized for the bottle production process in the Contiform H, which also enables aluminum molds to be used and reduces the machine's air consumption dramatically.

The Relax-Cooling (RC) technology also enables the Contiform H's flushing air consumption to be substantially reduced. This is the result of a small flow rate and a shorter flushing time.

Compressed Air Equipment at NPE2009

Hitachi America introduced their new third-party verified ISO 8573.1 Class Zero certification for their DSP Series oil-free rotary screw air compressors. The Class Zero verification tests were performed by Mitsubishi Chemical Analytech. The company also announced the expansion of their rotary screw product line to 300 horsepower, with new 132 kW, 145 kW, 160 kW, 200 kW and 240 kW models.

Atlas Copco featured their Class Zero capabilities prominently in their booth and offered customers free "walk-through surveys", which drew a lot of interest. Renner Kompressoren, based in Germany, announced their new partnership with Shrader to represent their air compressor product line in the United States. They have just launched their 5–50 hp rotary screw, belt-drive (with available VFD) product line. Cameron had a booth where they displayed their oil-free, centrifugal compressors and also introduced their new MAESTRO suite of programmable centrifugal compressor controls.

Joe Mashburn, of AF Compressors, stands in front of the new "low-pressure", 7–16 bar piston air compressor the company introduced at NPE2009.

Kaeser Compressors displayed their variable frequency/speed drive SFC Compressors and their Sigma Air Manager air system controller. Pictured are Keith Baker, Tracy Carter and Dan LeViness of Kaeser (left to right).

BOTTLING SYSTEM AIR RECOVERY & SUSTAINABILITY AT NPE2009

Vaisala displayed their DRYCAP® hand-held dew point meter. Pictured are Steve Santoro and Barry Eisan of Vaisala (left to right).

Hitachi displayed their new third-party certified Class Zero, oil-free, rotary screw air compressors. Pictured are Nitin Shanbhag, Larry Cooke, and Camilo Villalobos of Hitachi (left to right).

AF Compressors introduced their new range of 7–16 bar, oil-free, piston air compressors. These air compressors are designed for the innovative "air recycling/recovery" systems they are working on with the different blow molding equipment manufacturers. Gardner Denver Bellis & Morcom displayed their PET compressors, designed for bottle blowing. GD Elmo Rietschle also displayed their vacuum and pressure solutions for the plastics industry.

Kaeser Compressors had a large booth displaying many products, including their Sigma Frequency Control (100 to 450 hp) air compressors featuring variable frequency/speed drive technology. Kaeser also showcased their Sigma Air Manager designed to monitor and sequence up to 16 air compressors.

Vaisala had a booth where they displayed their DRYCAP® hand-held dew point meter. The unit is portable and designed to measure dew points ranging from -76 °F to 140 °F. Dekker Vacuum Technologies also displayed the newly launched P3 Commander, their newest advancement in the control and monitoring of vacuum systems.

Conclusion

My apologies go out to the companies not mentioned due to lack of space for this article. Milacron is leading a very strong sustainability initiative with their injection molding machines. Conair is introducing very energy efficient plastic-resin dryers. The chiller manufacturers, like Berg and Frigel, are driving down cooling system energy costs…and so on.

I personally think the NPE shows are among the best industrial shows in the world, when one looks at the quality and volume of visitors — and the quality of the exhibits. Impressive to me was the degree of focus the packaging and bottling line manufacturers have on improving the energy efficiency of their equipment and processes. I am very much looking forward to NPE2012. BP

For more information, contact Rod Smith, Compressed Air Best Practices® at rod@airbestpractices.com

RESOURCES FOR ENERGY ENGINEERS

TRAINING CALENDAR

TITLE	SPONSOR(S)	LOCATION	DATE	INFORMATION
Compressed Air Challenge® Fundamentals of Compressed Air	AIM Power DOE EERE	Memphis, TN	8/18/09	David Hollis or Brad Scott tel: 901-363-2200 david.hollis@aimcompanies.com www.compressedairchallenge.org
Compressed Air Challenge® Fundamentals of Compressed Air	AIM Power DOE EERE	Smyrna, TN	8/20/09	John Elias or Steve Sanders tel: 615-641-3100 john.elias@aimcompanies.com www.compressedairchallenge.org
Compressed Air Challenge® Fundamentals of Compressed Air	PNM DOE EERE	Albuquerque, NM	9/10/09	Carmen Chico tel: 505-241-4404 Carmen.Chico@pnm.com www.compressedairchallenge.org

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

INDUSTRY NEWS

CAGI Names New President

Frank Mueller, president of Kaeser Compressors, Inc., was recently named president of the Compressed Air and Gas Institute (CAGI). Mueller will serve in the post for two years. "CAGI has done an excellent job of raising awareness on the importance of compressed air," commented Mueller. "During my term, we will continue to make CAGI the credible voice of the industry, ensuring that end users understand energy efficiency, proper installation and function in relation to their individual choices in compressed air systems."

Promising ongoing education and training initiatives, Mueller cited CAGI's Smart Site (www.cagi.org), with its seven online modules, as a resource for manufacturers, members, end users and service providers alike. "We are committed to providing real, tangible value to those who work in the compressed air industry, general manufacturing and light industrial/commercial services… and we do that by offering up-to-date training and continuous improvement." Mueller's term is effective immediately and will run until May of 2011. "It is my honor to serve, and I look forward to working with all member companies to build on my predecessors' accomplishments and to meet or exceed our shared objectives," remarked Mueller.

Kaeser Compressors
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www.kaeser.com

RESOURCES FOR ENERGY ENGINEERS

PRODUCT PICKS

Air Compressor Achieves ISO 8573-1 Class Zero

Hitachi America, Ltd., Air Technology Group, announced the achievement of ISO 8573-1:2001 Class 0 for Hitachi DSP Series Oil-Free Rotary Screw Compressors.

"Merely having a compressor design that is devoid of oil from the compression stream is not enough. Our focus on the downstream air quality and possible contaminants serves to protect our customers' most valued production processes," noted Nitin G. Shanbhag, senior manager of the Hitachi Air Technology Group.

Mitsubishi Chemical Analytech — Tsukuba Analysis Division, was contracted to independently test the DSP Series Compressor against the standard. Hitachi DSP Series Oil-Free Compressors were confirmed to achieve the ISO 8573-1:2001 Class 0 air quality classification after the most rigorous testing.

Hitachi America
Tel: 704-494-3008 x 28
Email: airtechinfo@hal.hitachi.com
www.hitachi-america.us/airtech

Quiet Reciprocating Compressor

The BelAire Quiet Performance (QP) Series air compressors perform at less than half the noise of a standard reciprocating compressor. With noise levels less than 66 dbA, the BelAire QP can be installed directly in the work area. Standard features include magnetic starter, low oil-level switch, pump-mounted aftercooler, high-temperature shut down, automatic tank drain and vibration isolator pads. Inside the high-strength ABS sound-dampening enclosure, a high-flow fan ensures superior cooling. Models include 5 and 7.5 horsepower units, single- and three-phase.

BelAire Compressors
Scott Barlowe
Tel: 877-861-2722
Email: Sales@belairecompressors.com
www.belairecompressors.com

New Low-Noise Compressor Package

Gardner Denver's new Paradigm is ideal for applications with intermittent duty and low-noise requirements. The quiet Paradigm compressor package delivers powerful performance, easy maintenance and reduced noise for maximum customer satisfaction. With sound levels as low as 67 dBA, the Paradigm is the best compressor choice for any application.

Gardner Denver
Tel: 800-682-9868
www.gardnerdenverproducts.com

New Diagnostic Software for Ultrasound Inspection

UE Systems, Inc., developers of the Ultraprobe 10,000, the most advanced digital ultrasound inspection system, introduced the improved Spectralyzer 4.0, a powerful diagnostic software tool that converts a PC into a fully functioning Fast Fourier Transform (FFT) analyzer. The 4.0 is now even more effective than the previous version, featuring new analytics and reporting capabilities that improve the diagnostic process, thus making it easier to use and more accurate than ever. Alan Bandes, UE Systems VP of Marketing, says, "The Spectralyzer 4.0's new functions are a great asset to facilities maintenance managers. Among the improved features are harmonic cursers that are more easily controlled and can be set by numerical values. However, the most important asset is the convenience of exporting reports into simplified file formats."

UE Systems, Inc.
Alan Bandes
Tel: 914.592.1220
Email: abandes@att.net
www.uesystems.com

PRODUCT PICKS

High-Efficiency Compressor Controller

Standard Pneumatic Products announces their Universal Autodual Compressor Controller, which will operate a compressor plant of any horsepower or technology at its maximum efficiency level. Adding totally unloaded soft starts, automatic dual control (time-out-to-stop) and automatic lead/lag control (up to three machines), the Universal Autodual controllers convert an old compressor plant to a top-notch, modern, high-efficiency operation. In many areas, the installation will qualify for a utility rebate.

Standard Pneumatic Products
Bob Foege
Tel: 203-270-1400
Email: bfoege@stdpneumatics.com
www.stdpneumatics.com

New Compact Screw Compressor

The CD Series from Boge provides a small, quiet and compact screw compressor solution ideally suited to smaller industrial-compressor users, such as garages and workshops.

The CD9 screw compressor comes with a built-in refrigerant dryer. The enhanced design of the refrigerant dryer benefits the compressor cooling system. The CD9 is available in the standard pressure of 115, 150 and 190 psi. Output capacities range from 32–45 cfm, with a 10 horsepower motor.

BOGE America
www.boge.com/us

New Kilowatt Hour Transducers

Onset Computer Corporation announced a family of kilowatt hour (kWh) transducers for use with HOBO® data loggers. The WattNode® transducers provide high-accuracy measurements of 1-, 2- or 3-phase power in 2-, 3- or 4-wire configurations. They connect directly to Onset's web-based HOBO U30 monitoring systems and standalone HOBO Energy Logger Pro™ data loggers, and are easy to install in service panels and junction boxes. Typical applications include energy monitoring, sub-metering and phase-load monitoring.

Onset Computer Corporation
Tel: 1-800-564-4377
sales@onsetcomp.com
www.onsetcomp.com

New Transfer Tubes for Pneumatic Conveying

Anver TT Series Transfer Tubes are powered by compressed air and employ the Venturi principle to instantly create vacuum, controlled by regulating the input pressure, for conveying a wide range of materials at different speeds. Featuring smooth bores and no moving parts, materials actually pass through these transfer tubes, which are totally maintenance-free and explosion-proof. Suitable for a wide variety of applications, Anver TT Series Transfer Tubes come in bore sizes from 0.375" to 1.0" I.D., with infinitely adjustable airflows from 15 to 95 scfm, respectively. Machined from aluminum and anodized, these transfer tubes use no gaskets or O-rings and are available with optional mounting clips. One air source can operate several tubes.

Anver Corporation
Mark Laycox
Tel: 800-654-3500
e-mail: mlaycox@anver.com
www.anver.com

RESOURCES FOR ENERGY ENGINEERS

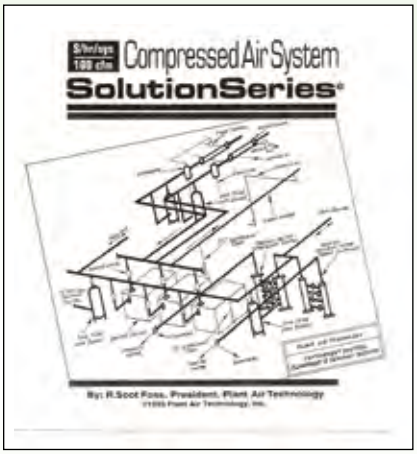
LITERATURE & SERVICES PICKS

The Compressed Air System Solution Series©

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

In his conversational format, this 1100-page book with 165 illustrations brings you solutions with a straight-on common-sense approach supported by technology. He focuses on concepts and applications, which are guaranteed to improve production results and energy efficiency. The chapters of the book are as follows:

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



The cost of the book is $295.00. To order the book, make a check or PO out to: Air's a Gas, Inc., 3728 Berenstain Drive, St. Augustine, FL 32092, or call 904-940-6940, or fax 904-940-6941 or email: airsagas@aol.com. A portion of the proceeds of this book are donated to select children's charities.

The Book on Compressed Air Common Sense Answers

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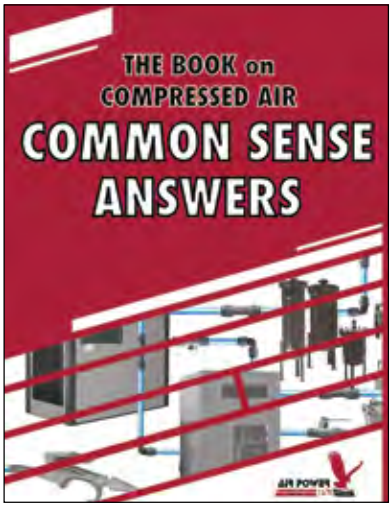

WALL STREET WATCH

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 in this column was gathered on July 29, 2009.

JULY 29, 2009 PRICE PERFORMANCE	SYMBOL	OPEN PRICE	1 MONTH	6 MONTHS	12 MONTHS	DIVIDEND (ANNUAL YIELD)
Parker-Hannifin	PH	$47.16	$46.58	$38.01	$78.35	2.10%
Ingersoll Rand	IR	$27.26	$22.81	$16.05	$42.32	2.58%
Gardner Denver	GDI	$28.61	$25.04	$22.36	$45.92	—
United Technologies	UTX	$52.14	$51.80	$49.44	$64.04	2.94%
Donaldson	DCI	$37.54	$34.81	$31.71	$43.80	1.22%
EnPro Industries	NPO	$17.79	$18.11	$19.42	$35.72	—
SPX Corp	SPW	$50.84	$47.73	$46.74	$119.80	1.85%

Ingersoll Rand Completes Change in Place of Incorporation

Ingersoll Rand PLC (NYSE:IR) announced that it has completed its previously announced reorganization, changing the jurisdiction of incorporation of the parent company of Ingersoll Rand from Bermuda to Ireland. The reorganization was completed on July 1, 2009, prior to the opening of trading on the New York Stock Exchange (NYSE).

"Ireland is home to approximately 700 Ingersoll Rand employees operating in manufacturing, sales and corporate roles," said Herbert L. Henkel, chairman and chief executive officer. "Ingersoll Rand's Thermo King business has a major manufacturing site in Galway and many of the company's European Region shared services are based in Swords.

"In addition to its stable economic, legal and regulatory environment, Ireland enjoys strong relationships as a member of the European Union. Ireland also enjoys a long history of international investment and a good network of tax treaties with the United States, the European Union and several other countries where Ingersoll Rand has major operations."

WALL STREET WATCH

Donaldson Company, Inc. (NYSE: DCI) announced updated guidance for FY09 and its financial results for the quarter ended April 30, 2009.

Summarized financial results for the periods ended April 30 are as follows (dollars in millions, except per share data):

	THREE MONTHS ENDED APRIL 30			NINE MONTHS ENDED APRIL 30		
	2009	2008	CHANGE	2009	2008	CHANGE
NET SALES	$413.4	$587.8	-29.7%	$1,447.3	$1,625.1	-10.9%
OPERATING INCOME	37.7	63.5	-40.7%	135.2	177.9	-24.0%
NET EARNINGS	26.6	46.0	-42.2%	108.4	123.4	-12.2%
DILUTED EPS	$0.34	$0.57	-40.4%	$1.37	$1.52	-9.9%

Included in the above results are pre-tax restructuring expenses of $6.8 million in the quarter and $11.1 million year-to-date. The impact of these restructuring expenses reduced diluted EPS by $0.06 in the quarter and $0.10 year-to-date.

"Although we continue to experience very challenging and severe recessionary conditions in almost all of our end markets, I am very pleased that our gross margin improvement, cost reduction and working capital improvement projects helped us significantly in our third quarter," said Bill Cook, Chairman, President and CEO.

"We generated record free cash flow of $100 million in the quarter and $171 million year-to-date. This has allowed us to further reduce debt by $39 million this quarter while still increasing our global cash reserves. Our balance sheet is very strong as we continue to improve our working capital utilization."

"Our overall sales were down 30% in the quarter and, excluding the exchange rate movements impact, sales were down 24%. In our Engine Products segment, local currency sales decreased 26%, although our sales of retrofit emissions and Aerospace and Defense Products remained ahead of last year's levels. In our Industrial Products segment, local currency sales decreased 21%, as our Industrial Filtration Solutions, Gas Turbine and Special Applications businesses all experienced sales declines. Market conditions were also weak globally as our local currency sales decreased by 17% in Asia, 22% in the Americas and 32% in Europe."

"However, our operating margin improved in the third quarter to 9.1%, compared to 6% in our second quarter, despite these sudden and sharp sales declines in many of our businesses. We continued to proactively expand our restructuring actions and realized savings of approximately $20 million from the actions completed in the previous two quarters. Unfortunately, these restructuring actions included further headcount reductions of 850 employees in our third quarter, for a total work-force reduction of 2,700, or 20%, since the beginning of our fiscal year. We anticipate that the cumulative effect of the restructuring actions during FY09 will generate approximately $100 million of annualized cost savings when completed."

"Based on recent feedback from key customers, we are planning for this global recession to continue at least through the fourth quarter of FY09. Consequently, we will consider and make further adjustments to our business plans and cost structure as necessary. We remain committed to protecting the health of our company and our ability to serve our customers. Our restructuring efforts, although difficult, are allowing us to successfully lead our company through this recession while positioning ourselves to profitably capitalize on future opportunities. We will return to our long-range strategic growth plans when economic conditions improve."

FY09 Outlook

We foresee the current recessionary conditions continuing at least through the fourth quarter of our fiscal 2009.

We forecast total FY09 company sales to be between $1.8 and $1.9 billion, or down 15–20% from the prior year. Foreign currency translation is expected to account for about 25% of this decrease. This assumes the Euro at US$1.36 and 96 Yen to the US$ for our fourth quarter.

Due to our lower sales outlook, we believe that lower absorption of fixed costs will continue and, as a result, we are considering additional restructuring actions that could result in an additional $10 to $12 million in additional costs in our fourth quarter. Including these costs, we have updated our full year operating margin guidance to between 8–9%.

"Although we continue to experience very challenging and severe recessionary conditions in almost all of our end markets, I am very pleased that our gross margin improvement, cost reduction and working capital improvement projects helped us significantly in our third quarter."

— Bill Cook, Chairman, President and CEO, Donaldson

Following the favorable resolution of several tax contingencies this year, our full year tax rate should be between 17–19%.

As a result of our ongoing working capital improvement efforts, we expect record full year free cash flow of $180 to $200 million, up approximately $80 to $100 million from the prior year. We will continue to use our cash flow for dividends, select capital projects, the repayment of debt and increasing our cash balance.

With the reduction in our outlook due to the combination of exchange rates, weaker customer demand and including our estimated full year restructuring costs of $21–23 million, we now forecast our full year FY09 EPS to be between $1.55 and $1.70.

Industrial Products: We now forecast full year FY09 sales to decrease 12–17%, inclusive of the impact of foreign currency translation.

Our Industrial Filtration Solutions' sales are projected to decrease 13–18%. We expect the global manufacturing environment to further weaken, but at a slower pace than the last two quarters.

While we anticipate full year unit volume to be flat in our Gas Turbine Products business, we forecast our full year gas turbine filter sales to decrease 2–5% due to the impact of foreign currency translation. Based on feedback from our customers, we expect a slowdown in demand for large power generation projects over the next 12 months.

Special Applications Products' sales are projected to decrease 17–22%, primarily due to soft conditions in the hard disk drive market and the weaker industrial end markets for our membrane products. BP

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The WEEC conference features a large, multi-track agenda, a full line-up of seminars on a variety of current topics, certification programs and a comprehensive exposition of the market's most promising new technologies. WEEC also serves as the annual convention of the Association of Energy Engineers, and is attended by more AEE members each year than any other single event.

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- *Green Collar Economy*
- *Green & Sustainable Initiatives*
- *Geoexchange Technologies*
- *Renewable & Alternative Energy*
- *Federal Energy Management*
- *HVAC Systems & Controls*
- *Energy Services and Project Financing*
- *Energy Policy Regulatory Changes*
- *Solar & Fuel Cell Technologies*
- *Smart Grid*
- *Carbon Reduction*

WEEC's highly acclaimed GreenStreet® expo showcase, co-presented by the U.S. EPA's ENERGY STAR®, will again be a prominent part of the WEEC for 2009 to address the interests and needs of the large number of U.S. government professionals and private sector managers who traditionally attend. Here you can examine firsthand the latest green, sustainable, renewable & environmentally friendly energy – facility technologies now available for both new design and retrofit projects.

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