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June 2009

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SUSTAINABLE MANUFACTURING FEATURES

COLUMNS

FROM THE EDITOR

See you at NPE 2009!

We are looking forward to the 2009 version of The International Plastics Showcase (otherwise known as NPE 2009). Plastics is the nations 3rd largest manufacturing industry, employs over 1.1 million people and provides nearly $379 billion in annual shipments. We are pleased to once again provide an edition focused on the plastics industry and the energy-savings opportunities that molders have with their compressed air systems.

The System Assessment of the Month, written by Mr. Gary Shafer, details the steps a Canadian blowmolding facility took to eliminate costly moisture problems and to reduce energy costs by $62,000. The company saw a reduction in energy use of 830,000 kWh and received a 10-month ROI on their investment after receiving a $10,000 energy incentive rebate.

The Energy Manager Feature describes how Mr. Paul Lukitsch and his colleagues at Millipore are driving down energy costs internationally. Mr. Lukitsch is a very accomplished Energy Manager who has been focusing on compressed air systems for many years. He makes very interesting recommendations on how to get started, what tools to use and shares what his results have been. Millipore has a very impressive sustainability goal as they achieve net reductions in their numbers for GhG and kW — even as their firm continues to grow.

The Energy Rebate Feature provides information on ComEds' Year 2 Smart Ideas incentive program in Illinois. They are just now in June accepting applications for Custom Projects.

Last but not least, Mr. Hank Van Ormer shares with us the #1 energy-savings opportunity in injection molding plants. This comes after decades of experience with the plastics industry — so I hope you make your way to this article!

Blow-Off Air is the #1 Energy-Saving Opportunity in Injection Molding Plants

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

Johnson Controls, Dr. Pepper Snapple Group, PepsiCo, The Coca-Cola Company

SOURCED FROM THE WEB

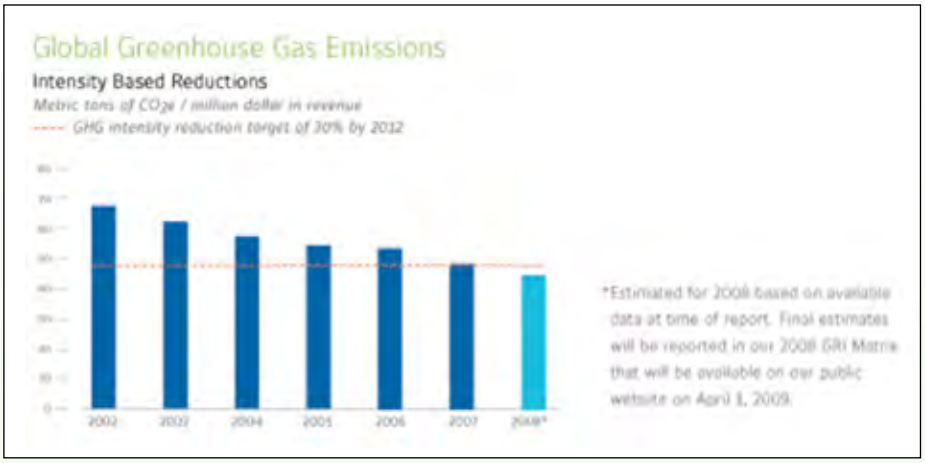
Johnson Controls Sustainability Initiatives

For Johnson Controls, demonstrating environmental sustainability is a vital element of the "walking the talk" philosophy we deliver in the marketplace. As a long-recognized leader in developing environmentally friendly "green" buildings, it's imperative that our own facilities are energy-efficient, use less water and minimize waste. During 2008, we continued to focus on our own operations to identify continuous improvement activities and better our performance.

We're currently expanding and renovating our headquarters in Glendale, Wisconsin, United States, with the aim of making it the world's first multi-building LEED platinum-certified campus. Leadership in Energy and Environmental Design (LEED) is the U.S. Green Building Council rating system — with Platinum being the highest certification. The buildings will be a showcase for energy-efficiency and renewable energy sources, including solar power, geothermal energy and gray water capture and use.

Ensuring accountability and greening the supply chain

Reducing the greenhouse gas footprint of our global operations. Each of our businesses is taking steps to quantify and cut its greenhouse gas emissions. We are adding hybrids to our service fleet, installing fluorescent lighting and power conditioning equipment in our plants and implementing manufacturing processes to reduce emissions and scrap.



Throughout our facilities, we are replacing metal-halide bulbs with newer fluorescent bulbs, an effort that saves both energy and money. The new bulbs deliver a better light spectrum and last longer. The retrofit program saved 33 gigawatt hours of electricity in 2008 — enough energy to power 30,000 homes for one year.

Greening the supply chain. We're quickly working to adjust the company's supply chain management policies and processes to support our sustainability goals. Our sourcing functions will incorporate sustainability into their supplier requirements, scorecards and evaluations.

We are a member of Climate Leaders, a U.S. voluntary industry-government partnership that encourages companies to develop long-term, comprehensive climate change strategies. We also committed — first to the U.S. Environmental Protection Agency (EPA) and later to other global agencies — that Johnson Controls would reduce its GHG intensity by 30% by 2012.

Finally, we joined the Carbon Disclosure Project's Supply Chain Leadership Collaboration, which is creating standards for supply chain reporting of emissions, risks, opportunities and strategies. This organization will provide a unified methodology to measure supply chain emissions using data collected directly from suppliers.

Source: www.johnsoncontrols.com

Johnson Controls

Dr. Pepper Snapple Group

DPS is an integrated beverage business that serves its customers and consumers via a broad and flexible distribution network.

Since 2006, DPS has nearly quadrupled its manufacturing capacity through acquisition and, as of 2008, operates 24 production facilities and more than 200 distribution centers with a fleet of more than 8,000 vehicles serving 34 states. We are continuing to refine and adopt sustainable business practices that minimize our environmental impact by focusing on four key areas:

Energy Conservation

We're upgrading our service and delivery fleet with cleaner, more fuel-efficient vehicles. In addition, new tractors are set with a five-minute idle shutdown to reduce emissions and save energy during deliveries.

DPS is working to replace existing cold drink equipment (coolers and vending machines) with new Energy Star-rated equipment that will save customers nearly $9 million annually in electric costs by 2012. The environmental impact of these efforts equates to removing the CO_2 emissions of 11,000 cars from the road each year or planting 16,000 acres of CO_2-absorbing forest land.

Water Conservation

In a growing number of plants, we are replacing empty package water-rinsers with air-rinsers, saving approximately 10,000 gallons per line per day at each site.

We are introducing state-of-the-art product blending systems that reduce liquid losses during production line changes, start-ups and shutdowns.

We are upgrading our water filtration systems to maximize the purity of water in our beverages while at the same time minimizing the amount of wastewater discharge.

We're exploring new ways to use recovered water, such as for plant irrigation and cooling systems.

SUSTAINABLE MANUFACTURING NEWS

Johnson Controls, Dr. Pepper Snapple Group, PepsiCo, The Coca-Cola Company

Recycling

DPS employee-driven initiatives are promoting awareness and best practices in paper, plastic and electronic equipment recycling at the company's Plano headquarters, field offices and production and distribution facilities.

In 2007, the Plano office recycled nearly 190 tons of paper, exceeding its 2006 total by 28%. These efforts saved 3,199 trees; 696,118 pounds of lumber; 565 barrels of oil; 771,374 kilowatts of energy; 1.3 million gallons of water; 565 cubic yards of landfill space; and reduced air pollution by 11,288 pounds.

Our containers are 100% recyclable. More than half of the aluminum we use in our cans is post-consumer. In addition, PET bottles contain an average of 5% to 10% post-consumer material.

We are continuing to expand recycling of solid waste throughout our manufacturing and distribution facilities.

In Mexico, our Peñafiel brand is a major participant in ECOCE, a nationwide public awareness and education initiative led by the food and beverage industry to promote container and package recycling.

Solid Waste Reduction/Light-Weighting

We have reduced the weight of our Deja Blue water bottles by 40% and our one-gallon Hawaiian Punch containers by 19%, taking approximately 6 million pounds of plastic out of the waste stream each year.

Our Mexican operation is introducing a new PET bottle with 10% less material.

In 2008, we will be introducing a light-weighted 2-liter bottle, reducing the weight of the bottle by between 2.5% and 9% depending upon the market and preexisting material. These changes will eliminate more than 1 million pounds of plastic each year.

In late 2008, Mott's, Clamato and Hawaiian Punch 64-oz. containers will be further reduced by 4.7%, taking another 1 million pounds of plastic out of production annually.

Throughout our business, we are working with our suppliers to reduce the amount of polypropylene and polyethylene in our bottle caps and will be rolling out smaller closures that are 3–4 mm shorter by 2009.

Source: www.drpeppersnapplegroup.com

PepsiCo Reduces Electricity Consumption by 9%

In 2007, PepsiCo agreed on rigorous, corporation-wide global metrics to help us better track and understand our environmental footprint. Our goal is to reduce water consumption by 20%, reduce electricity consumption 20% and reduce fuels consumption by 25% per unit of production by 2015 as compared to our 2006 consumption.

We continue to make a positive impact and have achieved significant results. In 2007, our beverage businesses reduced water consumption by 9%, electricity consumption by 9% and fuels consumption by 7%. Our food businesses reduced water consumption by 6%, electricity consumption by 3% and fuels consumption by 3%.

We have renowned environmental scientists and technical experts who are knowledgeable of leading edge scientific research and discoveries so we can leverage our operational capabilities to help make a difference.

We have in place a global eco-efficiency strategy for resource conservation (RECON) within our operations that helps us optimize our water, energy and electricity use through improved methods and technologies. We extend this strategy to our bottlers and co-packers through workshops around the world.

We have formed a series of partnerships with key external stakeholders to provide us with additional insights, expertise and knowledge on multiple aspects of sustainability. We will continue to actively lead and engage in key private-public partnerships to spur action and solutions to address the urgency of the world's environmental issues.

Source: www.pepsico.com

PEPSICO

SUSTAINABLE MANUFACTURING NEWS

Johnson Controls, Dr. Pepper Snapple Group, PepsiCo, The Coca-Cola Company

"Our containers are 100% recyclable. More than half of the aluminum we use in our cans is post-consumer. In addition, PET bottles contain an average of 5% to 10% post-consumer material."

— Dr. Pepper Snapple Group

Coca-Cola

The Coca-Cola Company uses energy and contributes to emissions through energy consumption at our offices and bottling plants. In our bottling plants around the world, we are investing to improve our energy efficiency. Fossil fuels provide the bulk of our energy, but we are investigating and supporting market development for renewable power. We also have developed an Energy-Efficiency Guidance Manual that includes best practices, which can improve energy efficiency in our operations by more than 10% and prevent about 500,000 metric tons per year of greenhouse gas emissions.

The three largest components of our system's energy consumption are manufacturing, fleet/transport and vending machines and coolers.

Manufacturing: Energy is consumed by our system's nearly 850 plants in the manufacturing process to provide the power for equipment such as boilers, chillers and air compressors.

Fleet/Transport: Energy is used by our system's fleet of approximately 200,000 vehicles to transport ingredients, packaging and finished beverages.

Sales/Marketing Equipment: Energy is used in our system's more than 9 million vending machines and coolers to keep products cold. The Coca-Cola system's vending machines and coolers are the largest contributor to greenhouse gas emissions within the system and produce three times the estimated emissions of our manufacturing facilities.

Across our bottling system, we are working to grow our business but not our carbon emissions. Since 2002, our energy use efficiency has improved by 19%. Going forward our efforts will be led by Project esKO, an initiative we launched in 2007 to improve energy efficiency and productivity and reduce emissions in manufacturing.

We started with the basics — fixing leaks, insulating pipes, reducing pressure and optimizing temperatures. From here, we are moving to investments in efficient lighting, compressor optimization and heat recovery. We also are making investments in combined heat and power and in renewable energy. BP

Source: www.thecoca-colacompany.com

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THE SYSTEM ASSESSMENT OF THE MONTH

A Plastic Injection Molder Saves Energy and Eliminates Moisture Issues

BY GARY SHAFER, iZ SYSTEMS INC.

June System Assessment of the Month

Where:	Canada
Industry:	Plastic Injection Molding
Issues:	Production Stoppage Due to Moisture
Audit Type:	Supply and Demand Side

System Assessment Win/Win Results

Reduction in Energy Use:	830,156 kWh
Reduction in CO_2 Emissions:	591.9 metric tons
Equivalent CO_2 for homes:	78 homes
Equivalent CO_2 for vehicles:	108 vehicles
Total $ Savings:	$62,262
Investment:	$60,918
Energy Rebate:	$10,000
Simple ROI:	9.8 months

Assessment Objectives

The facility is a plastics injection molder and is a division of a large corporation. The following information was produced from a compressed air system assessment done over seven days in 2008.

The compressed air system at this facility has been somewhat unreliable with quality problems that have escalated in the last several years. The compressed air system has significant water carryover to the process causing excess maintenance on machinery components. Lack of system reliability means the standby compressor(s) cannot be brought on line in a timely manner to prevent a process interruption. Typically, this type of shutdown happens only once or twice per year, but it triggers an expensive restart of the production machinery. As for operating cost, it is likely the system can be operated on a compressor half the size of the existing machines, even after the new production machinery is installed.

This compressed air assessment was proposed in order to determine the future needs of the plant with the proposed additional thermal welding equipment being installed, to remedy the quality issues and to identify a project to accomplish these goals. The focus of the assessment was to examine:

1. The root cause of water carryover to the system and provide resolution
2. The heat stakes on the thermal welding machines to determine the actual consumption of compressed air per unit and assess the impact on the compressed air system of adding similar machines to the production process
3. Determine the best fit compressor combination for existing and future needs

System Before Assessment		System After Assessment	
Operating hours:	8,760 hours	Operating hours:	8,760 hours
Power Cost kW/h:	$0.0750	Power Cost kW/h:	$0.0750
Avg. Air Flow:	580 scfm	Avg. Air Flow:	400 scfm
scfm/bhp:	2.28	scfm/bhp:	3.48
Annual Energy, kWh:	1,646,697 kWh	Annual Energy, kWh:	816,542 kWh
Annual Energy Cost:	$123,502	Annual Energy Cost:	$61,241

The Air Compressors

The plant currently operates one of two 250 horsepower two-stage rotary screw air compressors to generate the approximate 580 scfm consumed during normal production in the plant. Given the site conditions at the time of this work, the compressor(s) were each capable of generating 1200 scfm at full load on average. There is also a 100-hp compressor being installed to act as a trim compressor for either of the existing compressors based on anticipated needs from adding process machinery. The current energy costs for the system are $123k per year at the energy rate of $0.075/kWh.

The existing compressor operates fairly efficiently, but because it is more than 2.5 times larger than what is needed and operates at a relatively high sump pressure in the unloaded state, it never reaches less than 50% of full load power in the unloaded condition before it reloads to restore system pressure to the unload set point. Utilizing the 100-hp compressor being installed will meet the existing demand more efficiently; the new process machinery will likely require that a second 100-hp compressor to be installed so the existing 250-hp compressor can remain in standby while overall system efficiency is retained at its maximum scfm/kW.

Compressed Air Supply Power and Volume

Existing Arrangement

Air Compressor		Low Demand			scfm/bhp	Peak Demand			scfm/bhp
		bhp	kW	scfm		bhp	kW	scfm	
1	W2M250SSA	211	157	400	1.90	254	189	580	2.28
2	W2M250SSA	0	0	0	0.00	0	0	0	0.00
3	DSD100	0	0	0	0.00	0	0	0	0.00
	Totals	**211**	**157**	**400**	1.90	**254**	**189**	**580**	2.28

Proposed Arrangement

Air Compressor		Low Demand			scfm/bhp	Peak Demand			scfm/bhp
		bhp	kW	scfm		bhp	kW	scfm	
1	W2M250SSA	*0*	*0*	*0*	0.00	*0*	*0*	*0*	0.00
2	W2M250SSA	*0*	*0*	*0*	0.00	*0*	*0*	*0*	0.00
3	DSD100	*115*	*93*	*400*	3.48	*115*	*93*	*400*	3.48
	Totals	***115***	***93***	***400***	3.48	***115***	***93***	***400***	3.48

Notes

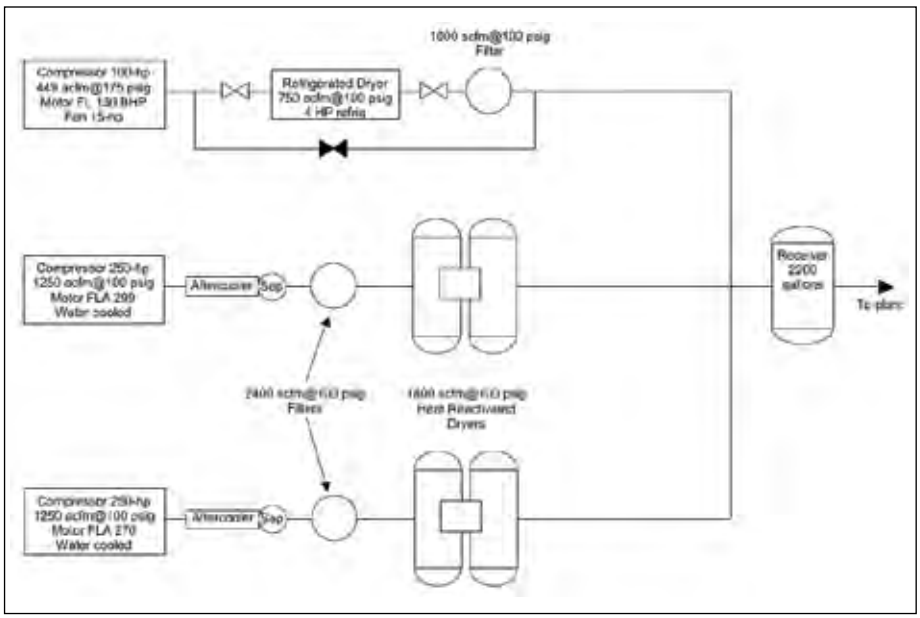
The proposed data is based on a target pressure 110 psi

THE SYSTEM ASSESSMENT OF THE MONTH

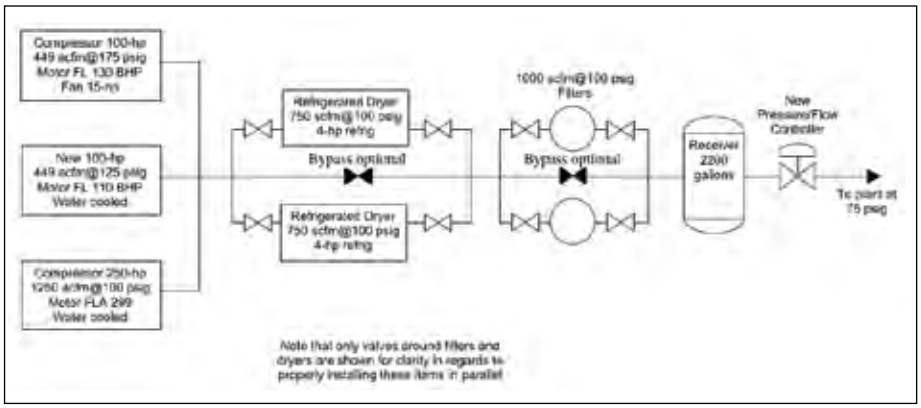
A Plastic Injection Molder Saves Energy and Eliminates Moisture Issues

Compressed Air Quality

The dryers in the compressor room simply do not work. It was thought at first that bed contamination from oil carryover was the key suspect; over the long term this may be true but not as the root cause of the current problem. Dryer #2 operates with the #2 compressor in a train, similar to the compressor/dryer trains #1 and #3. From a reliability standpoint, this means if one dryer is down for repair the other compressor *and* dryer must be used meaning they must both be in good repair and ready to operate.



Existing Process Flow Diagram.



Proposed Process Flow Diagram.

Because neither dryer is functioning properly and the purge of the #2 dryer alone represents 44% of the plant demand for air (plus the cost of operating its heater), it makes good economic sense to scrap these dryers in favor of the two new refrigerated dryers located in the compressor area, installing a third dryer that matches these two will provide redundancy but is not required in the short term to fix the moisture carryover problem and certainly provides no cost savings opportunity. Because the demand in the plant is not expected to exceed the capacity of one dryer, even after adding new production machinery, the two dryers represent 100% redundancy.

The two dryers must be placed in a parallel piping arrangement to ensure they are capable of servicing the needs of any combination of compressors that might be used.

Stability of Compressed Air Pressure

This is another facet of compressed air quality that is rarely addressed in system design. Currently, the system pressure to production swings more than 8 psig. Production management indicated that this was an issue when setting up process machinery for repeatable results. The reason this happens is inherent in the nature of load/unload controls and will not change with the installation of the 100-hp compressor (same type of control). Installation of a pressure/flow control will stabilize the system pressure to production.

The ideal situation is to allow the compressors (supply side) to operate at/near their design range, making load/unload, start/stop, etc., decisions while the demand side is held at a steady pressure somewhat below that level but high enough to support all demand side requirements on a repeatable basis. This is done with system pressure/flow controls and

requires adequate storage upstream in receiver capacity. The existing 2200-gallon tank is large enough because of its capacity versus the largest system event (loss of a compressor) and the control range available between the lowest supply side operating pressure and the highest demand-side requirement.

At present it is reported that the true pressure requirement on the process floor is 65 psig, the point where machinery will alarm and shut down. The pressure flow controller would be set somewhat above that as the target goal, say 75 psig, and this would then be the plant pressure specification going forward. All new equipment whether it is a small pneumatic tool or a large assembly machine must be able to operate at this pressure or have their own local supply of compressed air installed and maintained by the owner of the tool or equipment.

It is idealistic to assume the pressure/flow control would be set at 75 psig immediately after installation. The best approach is to set the controller at or near the existing pressure range minimum since the plant currently operates satisfactorily at this level. The pressure can then be slowly lowered to the target of 75 psig over time. During that time there may be point-of-use issues not revealed during this study that will need correction to accommodate the lower system pressure.

Reliability

Reliability means that the compressed air system will support the largest event in the system without production suffering any ill effect. These events can be a large end user on the demand side or the loss of the largest compressor on the supply side. At this plant, it is the latter that will impact the process since there are no demand side users larger than the loss of any of the installed compressors.

In the previous section, air quality *and* reliability are within reach, but the current operating philosophy must be changed to ensure reliability. Presently, the loss of a compressor means that pressure falls to the local alarm set points on production machinery (approximately 65 psig). Then maintenance personnel scramble to find out what is going on resulting in the startup of the standby 250-hp compressor. This almost always results in an expensive restart of production. Many hours of production can be lost although the costs are not included as part of the financial opportunities presented in this report.

Reliability and quality both depend on stabilizing pressure to production, having adequate storage and a good control strategy. It is recommended that as a minimum, the three compressors be automated such that the ideal combination can be operated and that standby compressors can start without negative impact on production. Since it is recommended that one of the 250-hp compressors be removed and a 100-hp compressor of similar size be installed to act as trim to the existing 100-hp compressor, only the existing 100-hp compressor will need to be retrofitted with automatic start controls. Maintenance people reported that the existing 250-hp compressors have these controls, and the new 100-hp compressor can be priced with this option during the bid process.

THE SYSTEM ASSESSMENT OF THE MONTH

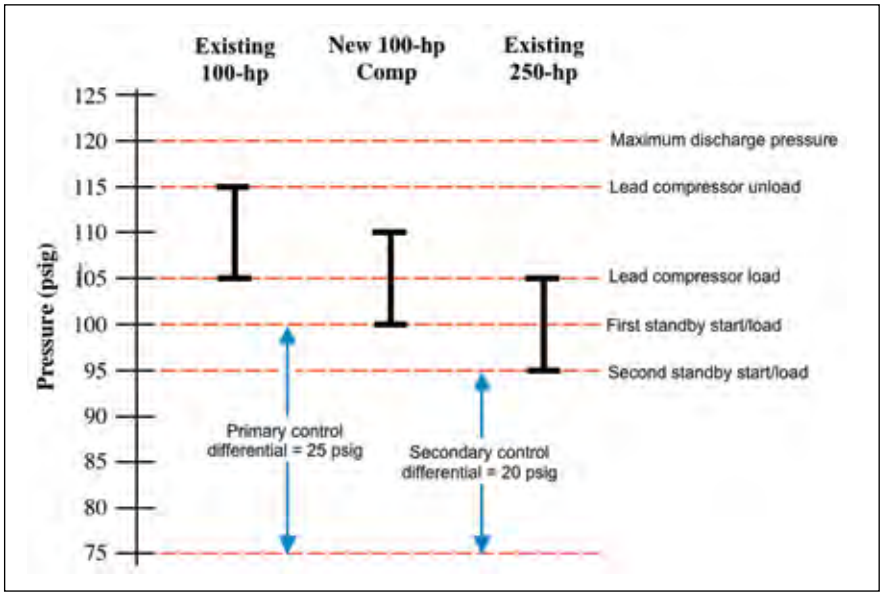
A Plastic Injection Molder Saves Energy and Eliminates Moisture Issues

"Annual energy savings of $62,000 will be realized."

— Gary Shafer, iZ Systems

It is not necessary to install central automation unless the plant personnel opt for this. Until the new production machinery is up to full capacity, it is anticipated that the 100-hp compressor will handle the demand on its own once the desiccant dryers are removed. After the new machinery is installed, there will only be occasions where the second machine might be needed but this is unknown. It is estimated that the plant demand will be approximately 400 scfm after the new machinery is installed; a number that is so close to the rated capacity of the existing 100-hp compressor it is impossible to predict how often a second compressor will be needed to trim for the first.

In order to start the standby compressor in time to back up the loss of an existing compressor, there must be adequate storage in the system. To calculate the storage requirement the control pressure profile must be constructed as follows:



The above control strategy represents a simple cascade arrangement that might be used in this system. Another option might be to use an embedded array where the lead compressor pressure band is "inside" the secondary, which is "inside" the standby. That type of arrangement is much more difficult to set up especially if the lead and lag compressors are changing in a weekly rotation on a manual adjustment. For now it is assumed that the 250-hp compressor will remain in the third (standby) position and the two 100-hp compressors will be alternated in and out of the lead positions on a normal basis. This means the maximum control differential is approximately 20 psig and that is what the storage capacity must be sized for. Assuming the 250-hp compressor can start and load within a 20-second interval, and the largest event is the full capacity loss of one of the 100-hp compressors (450 scfm), storage capacity is calculated as follows:

$$450 \text{ scfm} \times \frac{14.0 \text{ psia}}{20 \text{ psid}} \times \frac{20 \text{ sec}}{60 \text{ sec}} \times 7.48 \text{ gal/cf} = 785 \text{ gallons}$$

Total storage on the supply side, upstream of the pressure/flow controller needs to be a minimum of 785 gallons. The existing volume in the receiver alone is 2,200 gallons, nearly three times what is needed for this control strategy including all piping and miscellaneous volume, such as that contained in filters and dryers as an example.

Operating Costs

Installing the existing 100-hp compressor and both refrigerated dryers (and scrapping the two desiccant dryers) will solve two problems in the present: the single compressor will handle today's plant demand and the associated dryer will drop the pressure dew point and help eliminate moisture carryover to the plant. Note that lowering the dew point can help but not cure the issue; moisture carryover can be caused by other things such as poorly operating drain traps. The existing traps are all in various states of repair and only two have malfunction alarm lights (one is currently flashing at the receiver), otherwise there is no way to tell if any of the existing traps are working. Along with installing these dryers and filters, ensure that the traps are working; new, positive visual feedback traps that do not waste air are recommended for the future.

Further, the primary benefit of installing the refrigerated dryers and scrapping the two desiccant dryers is that it eliminates the manufacturer's stated 135 scfm of purge air and the average 6.4 kilowatts of heater power. This purge air rating is directly related to the purge orifice regulated pressure setting; the manufacturer's specification is based on a 45 psig setting, the actual observed was at 90 psig. This means the purge air could be as high as 240 scfm, but from closer analysis of the amperage draw on the 250-hp compressor, it is found to equate to roughly 180 scfm and 34 kW. (These are the numbers being used in the calculations in this report.)

Conclusion

With plant demand averaging 580 scfm during normal production and 400 scfm during low production periods, it is apparent that the 250-hp compressors are too big for this facility to operate economically. Not only will they consume more energy but they will also cost the same to maintain as they would in a facility using 2½ times as much compressed air. Currently, the electrical cost to operate the 250-hp compressor and heated desiccant dryer is approximately $123,000. Operating the 100-hp compressor and dryer at the same demand level will cost approximately $61,000 annually, a savings ranging near $62,000 annually. This assumes the desiccant dryers are eliminated.

For the future, the new process machinery will add in the range of 75–100 scfm total; removal of the desiccant dryers will eliminate 180 scfm and it is likely that the single 100-hp compressor will be adequate to supply the plant most of the year, especially if the compressor room is well ventilated to remove the air-cooled compressor's heat load. During the warmer months, the single 100-hp compressor might not be adequate and one of the 250-hp compressors may once again need to be in operation as the lead compressor. BP

For more information please contact Gary Shafer, iZ Systems, tel: 952-934-7325, email: gshafer@izsystems.com

THE ENERGY MANAGER

Sustainability at Millipore

BY ROD SMITH, COMPRESSED AIR BEST PRACTICES®

Compressed Air Best Practices® interviewed Paul Lukitsch. Mr. Lukitsch is the Regional Facilities & Energy Manager for Millipore Corporation.

How does Millipore approach Sustainability?

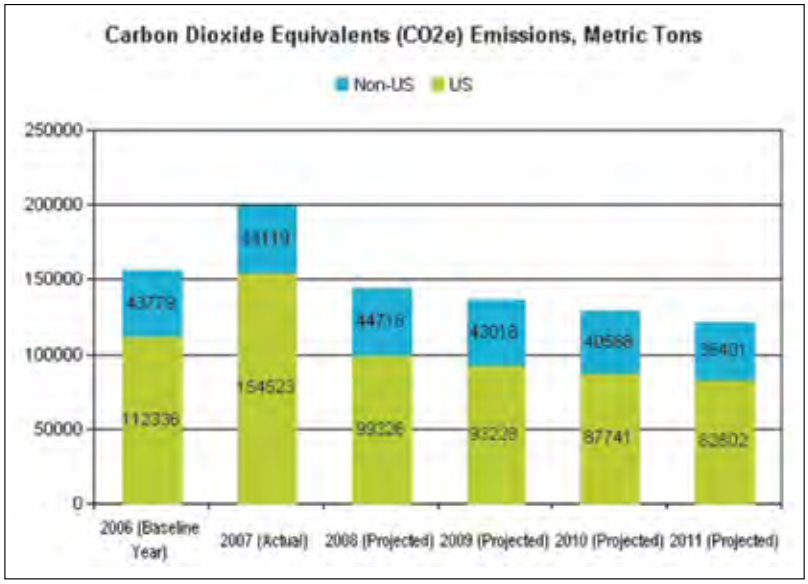
It starts from the top down at Millipore. Our President & CEO, Dr. Martin Madaus, recognizes that addressing climate change and other environmental issues important to our stakeholders requires a collective effort and dedication, both within Millipore and beyond. Dr. Madaus has not only launched ambitious sustainability programs at Millipore but also sets an example on a personal level by installing solar panels at his home and educating his children on the topic. He has expressed his focus on dramatically reducing impacts from our products and packaging, as well as those related to energy and water and our production waste. He is encouraging all employees to not only to make changes within the workplace but in their daily activities as well. He believes that all of these objectives, along with the company's ongoing commitment to serve and support its employees and the community, represent our clear sustainability priorities.

One of the first steps taken within Millipore by Dr. Madaus was to appoint a director-level manager, Mr. David Newman, to head the sustainability effort. Dr. Madaus believes that the concept of sustainability is simple — growing the business and being profitable but doing so in a way that allows us to preserve the environmental resources for future generations. Sustainability touches everything we do, which is why he is so pleased with the progress that we've made towards ingraining sustainability principles and practices into our operations company wide. There have been significant reductions in energy, water and waste. The results speak for themselves: an overall 12% reduction in energy use, some 152,000 m^3 of water reclaimed or otherwise conserved each year.

What is your Greenhouse Gas (GHG) Goal?

In May 2008, we publicly announced our goal of reducing the company's worldwide carbon footprint by 20% over five years from our 2006 baseline (see graph below). We're calculating this percentage in terms of an absolute reduction of GHG emissions.

We're off to a great start. To name just a few of the initiatives, we've saved over 5 million kilowatt-hours of electricity (vs. 2006) through our energy efficiency projects. We've completed two facility expansions and expect them to be LEED accredited. We've also upgraded our company auto fleet — 30% of the vehicles we lease in the U.S. are hybrids. Despite our growth, we have already achieved a 14% reduction in our GHG emissions since 2006.



** Chart was last updated on June 23, 2008.*

Please describe how many manufacturing facilities you are working with and what the primary processes are.

Millipore Corporation is a Life Science leader providing technologies, tools and services for bioscience research and biopharmaceutical manufacturing. We employ 5,900 people around the world and have global revenues of $1.6 billion.

We have multiple manufacturing facilities around the world. I'm responsible for overall operations at 11 facilities, totaling around one million square feet, located in Massachusetts and New Jersey. I'm also responsible for leading energy efficiency initiatives at our four largest manufacturing locations, which produce the lion's share of our products.

The main factories manufacture a wide variety of products for the life sciences industry — some are single-use disposable products and some are capital pieces of equipment.

THE ENERGY MANAGER

Sustainability at Millipore

"The results speak for themselves: an overall 12% reduction in energy use, some 152,000 m³ of water reclaimed or otherwise conserved each year."

— Paul Lukitsch, Millipore

Where are the opportunities for energy efficiency in manufacturing?

A comprehensive Energy Management program has to look at everything. We consume most of our energy in our main plant systems such as HVAC, boilers, lighting and compressed air systems. Several of our large manufacturing facilities consume large amounts of electricity due to compressed air systems necessary to run our manufacturing equipment.

We have replaced the traditional burner controls on two large boilers in our R&D Facility in Bedford with Autoflame controllers, providing independently controlled optimization of the combustion process. This technology offers micro modulation of the air and fuel valves and dampers, while an exhaust gas analyzer provides continuous combustion monitoring. The results are improved, stable, consistent emission profiles and significant fuel savings.

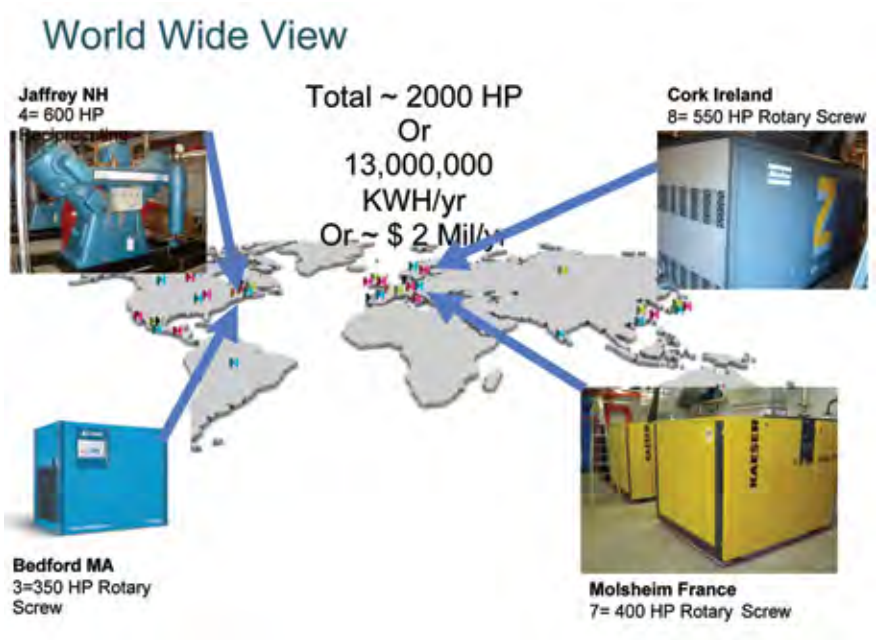
The HVAC systems vary in age and some are quite complex due to the fact that they also support R&D labs and clean-rooms. All have vigorous Preventative Maintenance Programs and are tied into building management systems. We don't see huge opportunities with HVAC — just incremental gains.

Air compressors are generally our largest horsepower electric motors on-site, and the overall efficiency of a typical compressed air system can be as low as 10–15%. So, pre- and post-monitoring of electricity use demonstrate the effectiveness of efficiency measures and allow us to prioritize work elsewhere.

What impact have compressed air energy efficiency projects had?

Millipore uses compressed air everywhere from injection molding, robotics, automation and pneumatics. Many are validated GMP processes.

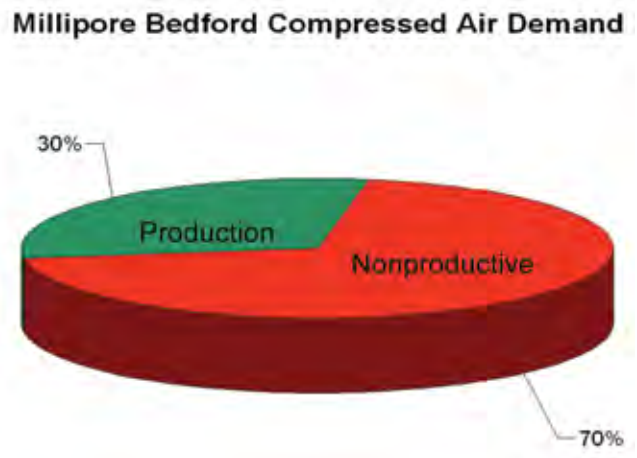
We have a connected load of air compressors totaling approximately 2,000 horsepower at the four main factories. After two years of demand-side projects, we have reduced the energy consumption of the compressed air systems by 2 million kWh and saved over $270,000.



Where did you start with the compressed air system?

Our end goal is to use less air compressor kWh per product produced. Before we started the reduction projects two years ago, we metered the demand per factory. The results showed us that ⅔ of the compressed air consumed in our facilities was not put to productive use. We started metering air-flow in our plants and focused on the demand side of the system, examining methods to use less air. We studied how air was being distributed and used instead of focusing on the supply side of the system — except for finding ways to shut air compressors off.

I can't overemphasize the importance of collecting data. You have to have data; otherwise, you and whoever is advising you is shooting in the dark. I like collecting data, analyzing it, taking actions and seeing a reduction in energy consumption.



THE ENERGY MANAGER

Sustainability at Millipore

We've installed over 50 CDI flow meters and kW meters, which are very easy and convenient to use. We strategically install them in the plants and data log the information from them — primarily focusing on the air-flow measurements. We connect the meters to our building management system and now produce weekly graphs of our compressed air consumption. The equipment operators and maintenance technicians get weekly reports on air consumption so we can move towards equating production output to compressed air consumption. As we compile data, we're moving in the direction of establishing best practices for specific processes in our facilities.

The graph below demonstrates the reduction of compressed air consumption over two phases of improvement work at our Bedford, Massachusetts site.

- Total metered savings Phase 1 = 274,188 kWh/Yr.
- Total metered savings Phase 2 =106,872 kWh/Yr.

Why the focus on measuring compressed air pressure and flow?

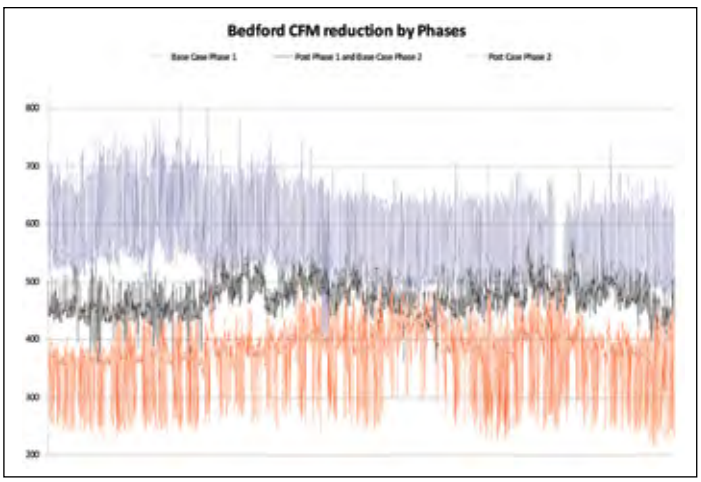
Measuring compressed air pressure and flow throughout the facility allows one to identify leak loads and pressure losses and pinpoint where the problems are. We measure at an idle state (when production is down) to determine our leak load, then measure the air pressure and flow during production.

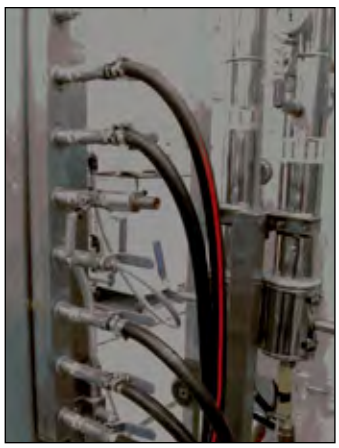
In addition, we look at the distribution systems to see if they are properly sized. Undersized header piping systems are common. In New Hampshire, the facility had experienced five to six expansions over the years and added many clean rooms with lots of pneumatics. For the latest expansion, the plant had installed separate compressed air systems for two areas. By collecting data, we concluded that we should combine the two systems, using a header consisting of 500 feet of interconnecting 4-inch diameter stainless steel piping. In this way, we were able to drop five air dryers and run the entire plant on one air compressor rather than three.

How do you manage "Demand Events"?

By measuring flow and pressure, we've been able to identify big "Demand Events" in our facilities. A "Demand Event" is when large volumes of compressed air are required for short time durations. For Millipore, an example of a big demand event is when we make membrane media for filters. We use PIAB vacuum systems during the slitting operation. We have optimized this process by working with PIAB, whose products have improved and use less air than prior designs, and by using secondary compressed air storage tanks to isolate this demand event.

When we are testing the compressed air system, we lower the compressed air pressure in the system until we detect an alarm condition on a piece of equipment. We then engineer a solution for that machine, such as point-of-use storage, so that it can operate with a lower supply pressure in the overall system, thus saving kWh.





Manifold for Injection Molding — Before.

Manifold for Injection Molding — After.

Any specific success stories?

Sure. We had a large molding operation in a clean room in our Cork, Ireland facility. They had a 7 bar (≈100 psi) over-all compressed air system and a dedicated 10 bar (≈140 psi) compressed air system for the molding machines. We had never seen that in other molding systems. The plant operators said that the molding machines would not work without 10 bar inlet pressure. We installed gauges and detected significant pressure drops within one of the molding machine's pneumatic circuits. The Cork plant personnel disassembled the molding machine's piping and discovered obstructions blocking air-flow! The obstructions were removed and now this process can run on 7 bar pressure. This is a great example of a situation where relying on data led us to investigate further and ask more questions, thus establishing a best practice for the molding machines.

Any advice on what not to do?!

Don't buy air compressors without solid data to support your purchase. I received an email from one of our facilities saying that their air compressors were breaking down and that they were desperate. They were renting an air compressor and wanted to buy a new one based on the recommendation of a local air compressor sales person.

I told them to hold off on buying a new air compressor and sent them some flow meters. They installed the meters and we went through the data together to properly size the machine, storage and the distribution system. The result is a purchase of a machine half the size that the compressor salesman recommended.

How important is good advice?

We have been fortunate to work with some very talented consultants like Jeff Wright from Compressor Energy Services. Instead of being a compressor salesman, he is a systems engineer who shares my goal to shut off air compressors and save kWh. We rarely talk about air compressor technologies. Instead, we focus on demand-side efficiency opportunities, measurement techniques and how to interpret and understand data.

We work well with local utilities and capitalize on their incentive programs. We've received more than $100,000 in incentives from the New Hampshire and Massachusetts utility companies for our compressed air projects over the past two years.

I'm also a member of the Association of Energy Engineers (AEE) and the Association of Facilities Engineers (AFE). They help me continue my education on energy efficiency. Millipore recently received "Best Customer Submitted Energy Project in New England" from the AEE for the compressed air improvements made in our Massachusetts and New Hampshire sites.

At Millipore, sustainability is all about learning and acting upon data. It is personally very rewarding to have the opportunity to help implement these efficiency projects.

Thank you very much Paul for your insights. BP

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

THE TECHNOLOGY PROVIDER

The #1 Compressed Air Energy Savings Opportunity in Plastic Injection Molding Operations

BY HANK VAN ORMER, AIR POWER USA

Over the last several decades, Air Power USA has reviewed many various types of plastic injection molding operations throughout the United States. This article identifies the #1 most common compressed air energy savings opportunity we have identified over all these years — BLOW-OFF AIR.

NOTE: Please look at the footnote at the end of this article for clarification on an item you will see in each economic analysis.

The #1 Opportunity in all Plants — Compressed Air Blow Offs:

Regardless of application, there are several guidelines that should always be applied to compressed air used for open blow off:

- Use high pressure only as a last resort
- All blow off air should be regulated
- All blow off air should be regulated to the lowest effective pressure — higher pressure means higher flow, which may not be needed
- Use venturi air amplifier nozzles whenever and wherever possible — this will usually reduce blow-off air at least 50%, freeing up more air flow for other applications
- All blow-off air should be shut off (automatically) when not needed for production
- Consider a separate low-pressure air source for blow-off air — i.e., blowers

Plants with many ⅛" and ¼" inch lines running as blow off on units will use approximately 10 and 25 cfm each, respectively, at 60 psig.

One savings approach is to use an **air amplifier,** which requires less compressed air. Air amplifiers use venturi action to pull in significant amounts of ambient air and mixing it directly into the airstream, which amplifies the amount of air available at the point-of-use. Air amplifiers have amplification ratios up to 25:1. Using 10 cfm of compressed air can supply up to 250 cfm of blow-off air to the process and generate a 15 cfm of savings per ¼" blow off. Savings may be available using ⅛" lines, but the cost effectiveness will not be as great.

Another method for blow off to be investigated is the use of blower generated low-pressure air. This air is much less costly to produce on a dollar per cfm basis. It is the volume of air (cfm) that creates the mass or weight of the air that performs the blow off. The pressure influences the "thrust" out to the end of the nozzles where it quickly dissipates. Often a higher volume or weight of air at lower thrust (pressure) improves productivity and quality of the blow off over the higher pressure version.

Replace Blow-Off Air with a Mechanical Device and Eliminate the Compressed Air Use

At a plastic injection molding facility on the West Coast, compressed air was used in a sub-assembly area on parts sorters. Figure 1 shows one of (100), ⅛" tube air blows used in the tumblers/sorters throughout the plant. These blow offs are set to use 45-psig inlet-regulated compressed air and use a measured 3 cfm. Reviewing production records indicates an "on time" for this process of about 70% of the total 8,760 production hours per year. This results in an average use of 2 cfm each for a total usage of 200 cfm for the (100), ⅛" blow offs spread over 64 stations.

Figure 2 shows the mechanical device installed to perform the same task in the parts sorter to replace the ⅛" tube blow offs. This worked as well or better and used no air. This type of modification worked on all parts sorters of many different types of formed parts used in the sub-assembly area.

Figure 1.
Air blower on parts feeder bowl

Figure 2.
New bumper installed to replace air blower on parts feeder bowl

Economic Benefits of this Project:

Total amount of compressed air saved:	200 cfm
Annual recoverable energy cost per year (calculated):	$70.39 cfm/yr
Recoverable electrical energy cost value of the 200 cfm of compressed air saved:	$14,078/year
Cost of 200 mechanical blocks installed at $5.00 each:	$1,000

THE TECHNOLOGY PROVIDER

The #1 Compressed Air Energy Savings Opportunity in Plastic Injection Molding Operations

Try Venturi Amplifiers or Flow Inducers Whenever Possible

Many plants today have realized that an open tube blow off is inherently inefficient and that proper nozzles not only create a potentially more effective flow pattern but also induced ambient air flow allowing for potential lower volume of air use with enhanced performance.

The fact is that *all flowing air will bring along or induce ambient air to flow.* However, there are general-purpose dispersion nozzles often applied when a select designed venturi amplifier with amplification up to 25:1 may do even better using significantly less compressed air.

At a Northern Indiana plastics molding plant, the ¼" tube open blows (at 80 psig and 32 cfm compressed air flow in and about 80 cfm out to process) had been replaced with a very good dispersion control nozzle and reduced the compressed air from 32 cfm to 26 cfm and still delivered 95 cfm to the process — somewhat higher than the original 80 cfm of combined compressed and ambient air. The productivity and quality remained about the same.

During an audit site visit, a ¼", 25:1 amplification nozzle was tested using 10 cfm of compressed air and delivering 250 cfm of air to the process. This was a savings of 16 cfm per nozzle of which there were a total of 16 throughout the plant. The 250 cfm total flow to the process allowed an increase in line speed. The action item was to install quantity (16), ¼" amplifier nozzles in place of standard dispersion control nozzle for this application.

Economic Benefits of this Project:

Current volume of compressed air used with (16) dispersion nozzles at 26 cfm at 80 psig:	416 cfm
Total compressed air used by (16) 1/4" venturi amplifier nozzles at 80 psig:	260 cfm
Total compressed air volume saved:	156 cfm
Recoverable electrical energy value per cfm/year:	$86.34 cfm/yr
Net annual recoverable electrical energy cost savings:	$13,469/yr
Cost of (16) nozzles installed with regulator and filter:	$2,100

"The plastics molding plant increased line speed by 2%."

— Hank Van Ormer, Air Power USA

Comments

When a plant is confronted with a question regarding blow-off air, personnel often opt for a quick "which is the best for all operations?" solution. There is no answer for **all** operations. It behooves energy-oriented operations personnel to be familiar with all types of solutions. The most important questions are:

- Which solution has the most positive impact on productivity and quality?
- Will other methods that use less air do the same, better or worse?

In the case of the Northern Indiana plastics molding plant, the better performance of the higher flow volume actually allowed an increase in line speed of almost 2%. Alternatively, it may have also allowed the use of lower pressure to the nozzle (flow reduction). The important point is when evaluating open blowing operations, investigate carefully. What is capital cost? What is maintenance cost? What is energy cost? The same can be asked for other options like dispersion nozzles and venturi amplifier nozzles, etc.

We have found during audits and evaluations over the last 20 years that 70% of the time, or more, the correctly applied venturi nozzle produces the best results and obviously enjoys a very low capital investment.

THE TECHNOLOGY PROVIDER

The #1 Compressed Air Energy Savings Opportunity in Plastic Injection Molding Operations

"...70% of the time, or more, the correctly applied venturi nozzle produces the best results and obviously enjoys a very low capital investment."

— Hank Van Ormer, Air Power USA

Electric Eye

On production line compressed air users, such as blow off and others, use an electric eye controller to shut off the blow air (or other uses) when there is nothing there.

Figure 1 — Note the blow is still on while there is nothing on the line.

A plastics plant in Vermont had this situation. The normal runs on the line would have open spaces of various magnitudes on a continuing basis. The plant was running one large blow air line with a dispersion nozzle using a constant 42 cfm at 85 psig.

A simple, pre-packaged electric eye unit was mounted and installed in less than 15 minutes. During a run of several days' normal production, the average compressed air use fell to 20.45 cfm measured. BP

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

Footnote on Calculations in this Article:

$ cfm/yr recoverable

Average cfm reduction to actual recoverable energy cost reduction

This is not a fixed value but is calculated for each audit site and reflects a number of measures:

Actual input power measured in kW at a specific pressure

The power rate in either a blended (12 months total energy bill divided by the total kWh) or calculated base rate with all demand charges included

The specific power of each operating unit and the overall combined specific power (cfm/kW) of the combined multiple units operating at each set of conditions (i.e., production vs. non-production, etc.)

The number of operating hours per year per operating conditions

When the system review or audit is finalized, any energy cost savings not related to cfm demand reduction are deducted from the total (such as dryer savings in direct electric kW, compressor improvements in efficiency or specific power, compressor discharge reduction, etc.) to develop an accurate estimate of actual input energy reduction per cfm of air saved

Most importantly, this model considers each specific compressor and its part load operating efficiency depending on compressor type, capacity control and installation conditions and configurations. Differences in these factors can have a very dramatic effect on the actual recoverable input energy per cfm per year.

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ENERGY REBATES

ComEd Announces Program Year 2 Smart Ideas Incentives

BY COMPRESSED AIR BEST PRACTICES®

Background

The 2007 Illinois Power Agency Act established energy efficiency and demand response goals to be met by ComEd and other electric utilities in the state. To meet these goals, ComEd developed and launched a suite of energy efficiency incentives called Smart Ideas in 2008 that are expected to yield more than $155 million in savings during the programs lifetime. The portfolio could place ComEd among the top three utilities in the nation within a few years in terms of annual electricity savings achieved through energy efficiency. ComEd collaborated with numerous key stakeholders and performed a national review of energy efficiency best practices to develop Smart Ideas. This three-year portfolio of programs will empower both residential and business customers to manage energy bills in the future and could:

- reduce energy consumption by 1.2 million megawatt-hours, which is the energy needed to power 140,000 homes for one year
- reduce peak load by 330 megawatts, which eliminates the need for large peakers or single unit coal plants
- reduce carbon by the equivalent of removing 100,000 cars from the road

New Custom Program Announced

The Smart Ideas for Your Business program offers custom incentives for a variety of equipment and process improvements that lead to electricity savings. Incentives are typically granted for implementing energy efficient improvements that exceed standard practice but are not available through the Smart Ideas for Your Business prescriptive measures menu.

The more electricity your project saves, the more your business can earn in incentives — up to $0.07 per kWh saved up to a maximum of $200.

A wide range of electric equipment and process changes may qualify for Smart Ideas for Your Business custom incentives, including, but not limited to:

- Compressed air technologies — new equipment; properly sized, reduced horsepower compressors; compressed air storage systems; vacuum pumps
- Controls — CO_2 based ventilation; building management system programming; chilled water system upgrades
- Cooling — economizers; ventilation fans
- Lighting — LED outdoor lighting
- Miscellaneous — industrial process improvements
- Motors & Drives — variable frequency drives (vfD) for individual motors greater than 200 hp
- Refrigeration — ammonia compressors; insulated freezer doors

Applications for Custom Projects Available June 1, 2009

ComEd
An Exelon Company

Applications for Program Year 2* Smart Ideas incentives will be available June 1, 2009. This application should be used as the pre-approval form and again as the final incentive application form when submitting invoices and project substantiation. Your pre-approval or final incentive applications can be submitted beginning June 1, 2009. Please note that in order to be eligible for any Program Year 2 Smart Ideas incentive, decisions to acquire and install energy efficiency measures must have been made after April 1, 2009. Any energy efficient equipment or services purchased, contracted for or installation work conducted prior to April 1, 2009 will not be eligible for any Program Year 2 Smart Ideas incentive. BP

** Program Year 2 runs from June 1, 2009 through May 31, 2010. Incentives are limited. For more information visit www.comed.com, or call 888-806-2273*

The 2009 Independent Compressor Distributor Association (ICDA) Annual Meeting

BY COMPRESSED AIR BEST PRACTICES®

The 2009 edition of the ICDA was held April 26–29 in Ponte Vedra Beach, Florida. This was a special year in that it marked the 30th Anniversary of the ICDA Annual Meeting and the 150th Anniversary of Gardner Denver.

Gardner Denver's new EndurAir tank-mounted rotary screw compressor with air dryer package.

Attendance by the Distributors was very solid as representatives from companies across North America made the trip to the Marriott Sawgrass Resort. There was a buzz as the CEO of Gardner Denver, Mr. Barry Pennypacker, made the trip and delivered the Keynote Speech to kick-off the meeting.

The vendor exhibits had many interesting technologies on display. Gardner Denver, of course, had the largest booth and had important new technologies on display. First to mind was the new 20–150 horsepower oil-free air compressor range. The units use Variable Speed Drive motors using switch-reluctance technology. The air ends are single-stage and water-injected and use a reverse-osmosis water purification system.

Gardner Denver also announced significant new technologies for the 5–30 horsepower market. This included making the Hydrovane line of rotary vane air compressors available to Gardner Denver distributors. It also included the EndurAir range of compressed air stations, which include a rotary screw compressor, tank and refrigerated air dryer in one package. GD also introduced an energy-saving, cycling refrigerated air dryer using thermal mass technology.

Jay Francis discusses features on Gardner Denver's new cycling refrigerated air dryer.

Gardner Denver's Bryan Fasano displays the new oil-free air compressor.

I had an interesting discussion at the MTA booth where the gentlemen discussed "free-cooling" applications with their large, industrial chillers. "Free-cooling" Aries chillers use ambient air to cool the water when ambient temperatures are cold enough. This "cycling chiller" qualifies for energy rebates because it reduces the energy consumption of the refrigeration compressors by using ambient air on cold days and cooling the water with a dedicated fan and heat exchanger.

Don Joyce and John Medeiros from MTA displayed energy-saving "freecooling" chillers.

THE 2009 INDEPENDENT COMPRESSOR DISTRIBUTOR ASSOCIATION (ICDA) ANNUAL MEETING

Mark Storey and Michael Brown from Xebec presented an innovative vacuum regenerated air dryer.

Ed Ball and Patrick Hertel of Process Air exhibit the new circular air knife and a 40 hp 3.5 psi blower with enclosure.

Nick Herrig announced a new domnick hunter variable speed refrigerated dryer line.

Xebec announced its drive to set up new distributors in the U.S. by attending the show. As specialists in absorption air dryers, the company displayed a complete range. The technology that we discussed is the energy-saving VRA Series vacuum regenerated air dryer. The energy savings come in because it is a zero-purge dryer which uses a smaller blower/vacuum unit than a standard blower purge dryer.

Process Air Solutions had a big 40 horsepower blower in the booth. The unit delivers 2200 cfm at 3.5 psi with sound attenuation of 84 dba with the enclosure. What caught my attention the most, however, is their new Circular Air Knife. This custom-engineered product allows you to dry a product (like cables) from 360 degree angles. This is an improvement over trying to position multiple nozzles at different angles to dry off fibers, wires, pipe or cables. The company has had some great early success with this new design.

Parker was present with the multiple brands they are operating: domnick hunter, Zander, Airtek, Finite and Transair. DH is introducing a new Variable Speed Dryer for 1250 to 12,000 scfm and is having good success with their Nitrogen Gas Generators and Process Water Chillers. They cited the strong project ROI numbers of these products as factors in driving their growth.

Overall, the 2009 ICDA was a great experience in a great setting. I know the golfers enjoyed the TPC course and the chance to see each other again. I'm looking forward to the 2010 ICDA! BP

Bill Thomas and Mike Zarif from NortekBelair Corporation hosted a clay pigeon shoot-out!

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Utility and Energy Engineers, Utility Providers and Compressed Air Auditors share techniques on how to audit the "demand-side" of a system — including the **Pneumatic Circuits** on machines. This application knowledge allows the Magazine to recommend "**Best Practices**" for the "supply-side" of the system. For this reason we feature **air compressor, air treatment, measurement and management, pneumatics, blower and vacuum** technologies as they relate to the requirements of the monthly **Focus Industry**.

- **Compressed Air Users — Focus Industry**
  - A. Energy and Utility Managers share experiences
  - 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
- **Compressed Air Industry**
  - A. Profiles of Manufacturers and Distributors
  - B. Product Technologies Best Suited for the Focus Industries
  - C. Industry News

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THE TECHNOLOGY PROVIDER

Energy-Saving Compressed Air Resin Dryers

BY ROD SMITH, COMPRESSED AIR BEST PRACTICES®

Introduction

Resin drying is a critical step in the manufacturing process of injection molding, extrusion molding and stretch blowmolding. Compressed air resin dryers are one of the most commonly used dryers in the plastics molding industry. Recent advancements in compressed air membrane-type resin dryers have reduced the associated energy costs significantly.

Surface Moisture and Adsorbed Moisture in Plastic Resins

In plastics manufacturing, plastic resin material must be free of moisture before it is processed to ensure that the end product is defect free. Many of today's plastic resins are hygroscopic. If the moisture is not properly removed it will boil off when heated during the molding or extrusion process. This released vapor can cause both structural and cosmetic flaws in the finished product.

Multiple NovaDrier Compressed Air Resin Dryers Using Membranes from Novatec.

Most plastic resins, such as PA (Nylon), PC and PET, are hygroscopic materials. They adsorb moisture from humid ambient air and give moisture back to dry air. Every type of resin can hold a specific amount of moisture between its molecular chains. Additional amounts of moisture can be condensed on the surface of the pellets (surface moisture). Non-hygroscopic resins, such as PE, PP and PVC, do not adsorb any moisture, but they still can have surface moisture.

Adsorbed moisture in hygroscopic resins and surface moisture in non-hygroscopic resins are known to cause defects in molded plastics and they might lead to a complete production stop (source: www.fasti.com).

80% of Problems in PET Manufacturing Are Linked to the Drying Process

Wellman Inc. is a leading PET resin manufacturer. Their PermaClear® PET packaging resin is used in the manufacture of plastic beverage bottles and other food packaging containers. They claim that 80% of problems in PET manufacturing are linked to the resin drying process. This is due to the fact that PET (polyethylene Teraphthalate) is a very hygroscopic material — meaning it absorbs water into the molecular structure. The moisture absorption occurs through exposure to the environment during transit and storage.

Proper drying means a proper resin. To ensure molecular weight retention and optimum properties, it is recommended that PET must be dried to less than .005% moisture (0y weight %) prior to melting in the extruder. If excessive moisture is present, hydrolysis will occur during the molten state and will reduce molecular weight. This reduction in molecular weight will result in several changes in the PET preforms. The most notable will be greater than normal intrinsic viscosity (IV) losses and the increased rate of crystallization that will reduce clarity and cause haze in the preform.

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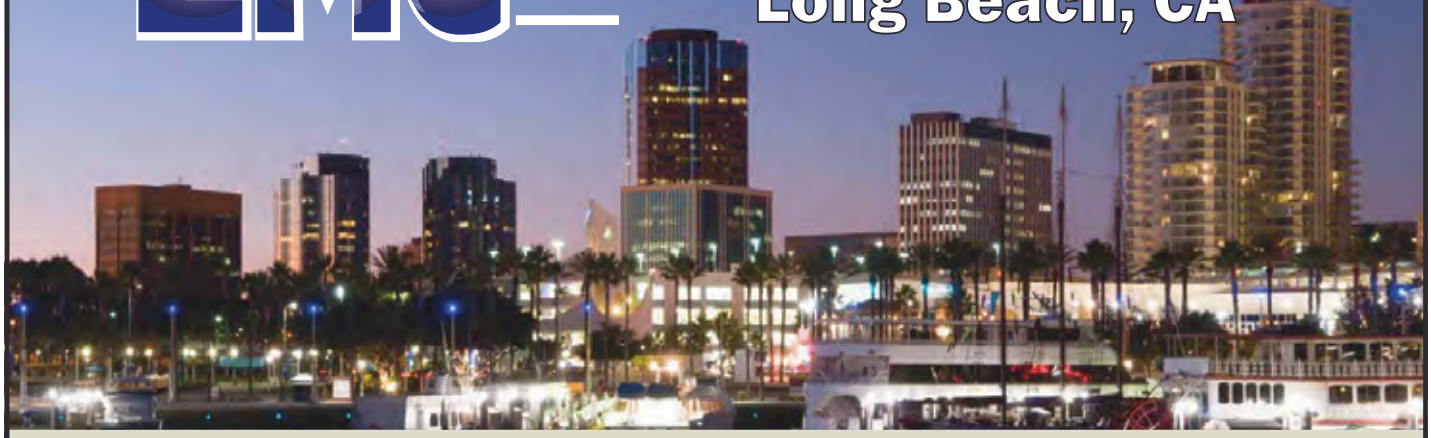

The **West Coast Energy Management Congress (EMC)** is the largest energy conference and technology expo held on the U.S. West Coast specifically for business, industrial and institutional energy users. It brings together the top experts in all areas of the field to help you set a clear, optimum path to energy cost control, energy efficiency, sustainability, and facilities optimization.

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THE TECHNOLOGY PROVIDER

Energy-Saving Compressed Air Resin Dryers

"A customer had a scrap rate of 10% on the car headlights they were manufacturing due to moisture. We were able to reduce that to ¼%."

— Mark Haynie, Novatech

Proper resins mean better end products. The primary purpose of the dryer is to conduct hot, dry, air that will allow moisture adsorption from the pellet to eliminate hydrolysis effects during the dryer residence time. Proper drying will reduce color shifts and minimize the generation of excessive levels of acetaldehyde (AA).\par. Regular measurements should be made of the resin moisture levels as well as Preform IV and AA levels to ensure optimum dryer operations and verify resin has been properly dried. A dehumidifying dryer is required for drying PET resins. Drying of PET resin is achieved through 7 key variables:

1. Temperature (recommended \fs18 \f0 \i 350 °F
2. Time (minimum of 4 hours)
3. Dew point (minimum of -20 °F)
4. Air-flow rate (minimum of 1 scfm/ Lb. of PET/hr)
5. Desiccant condition (checked regularly)
6. Proper resin flow through dryer (per manufacturers recommendations)
7. Proper air flow up through the dryer bed (per manufacturers recommendations)

(source: www.wellmaninc.com)

Compressed Air Resin Dryers

When you research this, one finds there are many different types of resin dryers on the market from many suppliers. The primary types of resin dryers are "hot air dryers," desiccant dryers, compressed air dryers, vacuum dryers and infrared crystallizer/dryers.

This article will focus on compressed air resin dryers. There are two types:

1. Compressed air resin dryers
2. Compressed air resin dryers plus membrane dryer

Compressed Air Resin Dryers for 0 to -20 °F Atmospheric Dew Points

There are many different types of compressed air resin dryers. Most, however, use the same principle of operation.

1. Plant compressed air (at 100 psig) is introduced at the bottom of the dryer (the "hopper" vessel where the resin is)
2. The compressed air is expanded to atmospheric pressure. This immediately reduces its atmospheric dew point by 40 to 50 °F
3. The air is then heated to raise its drying capacity
4. The air then passed up through the "resin hopper" and removes the moisture from the resin

Some compressed air resin dryer manufacturers state that the standard inlet compressed air quality to their resin dryers should be a dew point of 5 °C [41 °F] at a pressure of 7 bar [100 psi]. This equals atmospheric air with a dew point of -20 °C [-4 °F] at sea level. This, obviously, equates to the air quality a refrigerated compressed air dryer can supply.

Other manufacturers, however, simply state that their dryer must be supplied with compressed air with a 40 °F atmospheric dew point at 100 psi with an oil content of less than 3 mg/m3. Obviously, the air quality (and ability to remove moisture) of these systems will depend upon the inlet compressed air quality received.

There is a company, Fasti USA, which has designed a package incorporating the air compressor and refrigerated air dryers into the package. Most manufacturers simply source plant air. Their "Fasti L Series" product caught our eye because it claims to reduce or eliminate the electrical heating demand from the heaters by offering optional heat recovery systems, recovering waste heat from the air compressors. Depending upon the air compressor type, pre-heating the secondary and process air streams to temperatures between 180 and 360 °F can be reached using these heat recovery systems (www.fasti.com/about.php).

Compressed Air Resin Dryers with Membrane Dryers for -40 °F Atmospheric Dew Points

There are a number of suppliers of compressed air resin dryers who have incorporated membrane dryers. Novatech, based in Baltimore, Maryland, launched the NovaDrier product and was first to market in the year 2000. "Most units are used to process 25 to 50 lbs of resin per hour," according to Mark Haynie, the Dryer Product Manager at Novatech.

A typical extrusion plant installation might have 10–20 machines. The 25-lb unit requires 5 scfm of inlet air while the 50-lb unit requires 12 scfm of compressed air at 100 psig. This means that if the average extrusion plant has 15 machines processing 50 lbs of resin each, the compressed air requirement is 180 scfm for the drying process.

The method of operation of the membrane-type compressed air resin dryer is as follows:

1. Saturated (untreated) plant compressed air (at 80–125 psig) is introduced into two coalescing filters and then into the membrane dryer where a -40 °F atmospheric dew point is achieved
2. The air is heated to process temperature
3. The heated air is introduced into the bottom of the resin hopper to remove moisture from the resin at the bottom of the dryer (the "hopper" vessel)
4. The compressed air is expanded to atmospheric pressure. This immediately reduces its atmospheric dew point by 40 to 50 °F
5. The air is then heated to raise its drying capacity
6. The air then passed up through the "resin hopper" and removes the moisture from the resin

The New NovaDrier from Novatech Saves Energy by Reducing Compressed Air Consumption.

THE TECHNOLOGY PROVIDER

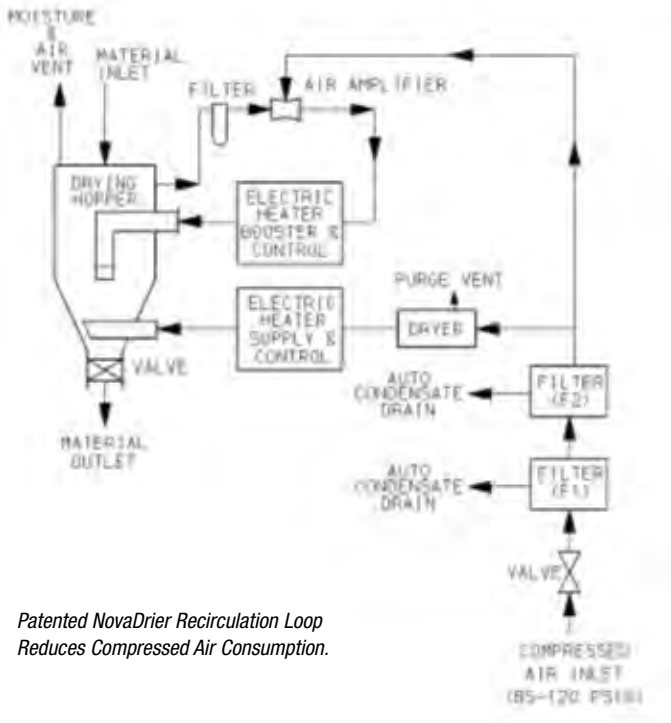
Energy-Saving Compressed Air Resin Dryers

> "The new generation uses on average $30,000 per year less in energy than other membrane-type resin dryers."
>
> — Mark Haynie, Novatech

An advantage to this design is the higher potential air quality and the lack of moving parts compared to other technologies. A disadvantage can be the use of higher amounts of compressed air as purge through the membrane dryer.

Enter new technology. The newly patented second generation NovaDrier from Novatec has found a way to reduce the compressed air consumption of the membrane air dryers. "The new generation uses on average $30,000 per year less in energy than other membrane-type resin dryers," says Mr. Haynie.

The new generation technology uses the same process as described above but also takes a part of the air stream to pre-dry the resin in the upper part of the hopper. According to Mr. Haynie, the patented recirculation loop is what keeps the compressed air consumption to ⅓ that of traditional membrane resin dryers.



Patented NovaDrier Recirculation Loop Reduces Compressed Air Consumption.

Conclusion

Resin drying is a vital part of plastic molding processes. Without reliable drying, scrap rates of end products can be business-threatening events. Mr. Haynie from Novatech commented, "A customer had a scrap rate of 10% on the car headlights they were manufacturing due to moisture. We were able to reduce that to ¼%".

Compressed air resin dryers are an important part of the resin drying market. Recent technological advancements reducing membrane purge air requirements have made the technology more energy efficient and a much more attractive resin drying option than before. BP

For more information contact Rod Smith, Editor, Compressed Air Best Practices®, email: rod@airbestpractices.com, www.airbestpractices.com

Technology for Saving Energy on Display at the 2009 Hannover Fair

BY COMPRESSED AIR BEST PRACTICES®

The Hannover Fair was held April 20–24th this year and it was as invigorating as ever. For individuals involved in reducing the energy costs of their industrial processes, the Hannover Fair is one huge brainstorming opportunity. In the ComVac Halle, where compressed air and vacuum systems technology was on display, the ideas for energy-savings were on display with professionals ready to discuss how to deploy them. While we don't have enough pages to feature everybody, here are some highlights:

Air Compressors

The Kaeser booth had many new technologies. The most intriguing to me was the new space-saving HSD Series which incorporates two air compressors into one cabinet. The single enclosure houses are dual compressor air-ends, motors, oil separation systems, Sigma control units and cyclone separators with drains. The range is 483 to 671 horsepower at 116 to 218 psi. For installations with varying demand, the user can pair up different size air compressors and have one unit be a base-load machine and the second a Variable Speed Drive machine. Mr. Frank Mueller, of Kaeser USA, said, "Both the HSD Series and heat recovery technologies are on the verge of being introduced in the U.S." He went on to say, "The 2009 Hannover Fair was the best show ever for Kaeser due to the record-level in-booth sales and high-quality sales leads received."

TECHNOLOGY FOR SAVING ENERGY ON DISPLAY AT THE 2009 HANNOVER FAIR

Kaeser's Mr. Erwin Ruppelt, Dipl-Ing., displays the new HSD Series.

ALMiG's Mr. Daniel Fritz displays the new oil-free air compressor.

ALMiG's heat recovery module.

Kaeser also introduced a new dry screw. This important new technology is a completely dry running system (no water). The units are air-cooled, two-stage compressors with available VSD, water-cooled and heat recovery. The DSG-2 and FSG-2 products cover a range from 121 to 476 horsepower. Also introduced at the fair was a 3–10 horsepower Airbox Center. This is a fully enclosed piston air compressor, tank-mounted, with an integrated air dryer. Finally, a new line of fully enclosed DB Series Blowers with integrated Omega Control, Wye-delta starters, VSD and other features was on display.

The German market seems to be installing "heat recovery" systems frequently now. "Heat recovery" is a heat exchange unit where the hot oil in the lubrication system can be used to heat water, for example, and used in another process in the plant. They can be 74% efficient meaning a 100 kW air compressor can provide 74 kW of heating. Both Kaeser and ALMiG prominently displayed heat recovery technology.

ALMiG Compressors (formerly known as ALUP) had a very interesting water-injected, oil-free air compressor. The unique technology is that the water (for compressor lubrication) comes from the integrated refrigerated air dryer — so no external water source is needed. The refrigerated air dryer generates enough condensate that the air compressor's water supply can be exchanged regularly so that no water purification system like reverse-osmosis is required. Mr. Daniel Fritz of ALMiG showed me around the booth and said he is actively engaged in developing distributors in the U.S.

Blitz Schneider has long been a leader in manufacturing air compressors for the automotive aftermarket in Germany. This year, the firm had a nice booster package for the PET market on display. The Atlas Copco Group had a booth with a number of the brands they are growing like Worthington and ABAC. There were many Turkish manufacturers of air compressors at Hannover — more than I can ever remember seeing. The leading Turkish manufacturer, EKOMAK, had a big booth where their European General Manager, Mr. Rolf Tappen, told me of the significant growth they have enjoyed in Germany over the past year.

Blitz Schneider's high pressure booster.

Compressed Air Treatment & Measurement

BEKO had a very interesting booth where they had on display very sophisticated compressed air measurement systems for both air flow and oil content. They said they are on the verge of having their oil-content measurement system certified. The importance of this system is that end users (attention food industry!) can and should consider (in my opinion) installing systems to verify that they have oil-free air, which will not contaminate their products.

VP Instruments, a Dutch firm, also had a nice booth with instruments designed to measure flow, pressure and temperature in compressed air systems. They also have a nice software system where one can visualize the read-outs from the instruments in the different parts of the facility. They call this the Air Vision Monitoring System.

SPX Hankison introduced a new line of compressed air filters with proprietary elements. Mr. Ingo Radisch, from SPX, said that the "Hybrid" dryers were also really starting to sell well in Europe. A Hybrid dryer is a combination refrigeration and blower purge dryer with very low energy costs.

Ultrafilter GmbH had a big booth. The company is the compressed air treatment supplier of the Ultra.Air Group whose primary mission is to conduct air treatment audits. The owner of both firms, Mr. Dean Kronsbein of Ultrafilter said, "We are looking for business partners in the U.S. who want to work with German technology." The company had a full range of air treatment products and is in an expansion mode.

Summary

The only sign of a sluggish economy was the notable absence of a number of long-time exhibitors in the ComVac Halle. Aside from that, the atmosphere was fantastic, and I was amazed at how many new technologies, ideas and companies I encountered. I spent 1½ days at the Fair and wish I had stayed three days. As always, I strongly recommend the Hannover Fair to anyone involved with compressed air systems. BP

BEKO's new oil-content measurement system.

SPX Hankison's Mr. Ingo Radisch with the new filter line.

Ultrafilter's Mr. Dean Kronsbein with their air treatment products.

RESOURCES FOR ENERGY ENGINEERS

TRAINING CALENDAR

TITLE	SPONSOR(S)	LOCATION	DATE	INFORMATION
Compressed Air Challenge® Advanced Mgmt. of Compressed Air Systems	Sacramento Utility District, DOE EERE	Sacramento, CA	5/27/09	Paul Gillaspy tel: 916-732-5375 pgillas@smud.org www.compressedairchallenge.org
Compressed Air Challenge® Fundamentals of Compressed Air	Iowa State Univ. Alliant Energy MidAmerican Energy Advantage Central Iowa Power Corp.	Iowa City, IA	6/16/09	Bill Haman tel: 515-294-8819 whaman@energy.iastate.edu Continuing Ed. tel: 505-241-4404 cepd-info@iastate.edu www.compressedairchallenge.org
Compressed Air Challenge® Fundamentals of Compressed Air	Iowa State Univ. Alliant Energy MidAmerican Energy Advantage Central Iowa Power Corp.	Ames, IA	6/17/09	Bill Haman tel: 515-294-8819 whaman@energy.iastate.edu Continuing Ed. tel: 505-241-4404 cepd-info@iastate.edu 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.

LITERATURE & SERVICES PICKS

New Energy Optimization System

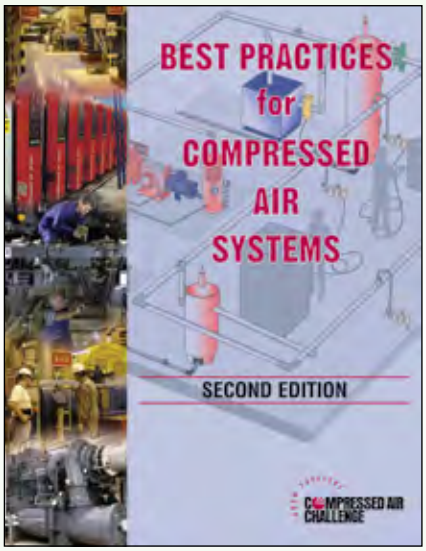
Boge America announced the launch of the airtelligence PROVIS energy optimization system. Optimized operating costs, reduced maintenance costs and energy efficiency are all benefits realized through integrating the airtelligence PROVIS into a compressed air system with multiple compressors.

Running a lean operation is a high priority for businesses now more than ever with the current economic climate imposing new challenges on industry. Compressed air is one technology that can turn around quick and significant energy related reductions. Where the user has more than one compressor, integrating an intelligent energy management system to control and monitor the compressed air system can assist them in achieving sustainable compressed air related energy efficiency.

BOGE America
Tel: 770-874-1570
Email: usa@boge.com
www.boge.com/us

LITERATURE & SERVICES PICKS

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



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

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

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

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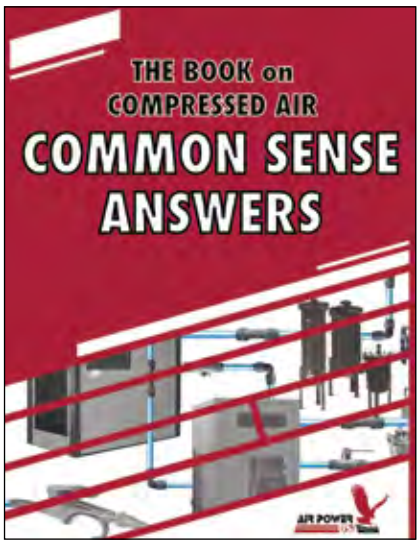
The Book on Compressed Air Common Sense Answers



NEW! Providing practical solutions to the everyday issues facing plant staff who operates and maintains plant air systems and the engineering staff who designs and evaluates air systems. Real life experiences flow throughout covering common problems and opportunities that touch all industries. New electronic energy-saving products are reviewed in detail and how to apply them through the complete air system, from the compressor room to the shipping dock. Savings calculation methods and measurement protocols are identified. Features "Ask the Experts" section answering questions posed by real users to Air Power USA staff. (Red book, Hard cover. 1st edition — 2009)

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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 May 2, 2009.

MAY 13, 2009 PRICE PERFORMANCE	SYMBOL	OPEN PRICE	1 MONTH	6 MONTHS	12 MONTHS	DIVIDEND (ANNUAL YIELD)
Parker-Hannifin	PH	$44.15	$37.70	$34.66	$85.69	2.24%
Ingersoll Rand	IR	$20.82	$16.53	$20.21	$44.43	3.37%
Gardner Denver	GDI	$26.49	$26.51	$21.88	$50.41	—
United Technologies	UTX	$50.40	$46.39	$49.01	$74.92	2.91%
Donaldson	DCI	$33.33	$30.66	$30.62	$46.05	1.35%
EnPro Industries	NPO	$17.55	$19.11	$18.73	$38.50	—
SPX Corp	SPW	$45.41	$43.91	$32.13	$127.63	2.24%

Gardner Denver, Inc. (NYSE: GDI) announced that revenues and preliminary operating income for the three months ending March 31, 2009 were $462.5 million and $37.2 million, respectively, and preliminary net income and diluted earnings per share ("DEPS") were $24.5 million and $0.47, respectively. The first quarter of 2009 included expenses for profit improvement initiatives and non-recurring items that reduced DEPS by $0.11 and a reduction of income tax expense due to the favorable resolution of certain tax matters that increased DEPS by $0.07. The preliminary results reported in this press release do not include a non-cash charge for impairment of intangible assets in the company's Industrial Products Group discussed in more detail below, as the full impact of the charge has not yet been determined.

Revised Reportable Segment Composition

Effective January 1, 2009, the company reorganized its five former operating divisions into two major product groups: the Industrial Products Group and the Engineered Products Group. The Industrial Products Group includes the former Compressor and Blower Divisions, plus the multistage centrifugal blower operations formerly managed in the Engineered Products Division. The Engineered Products Group is composed of the former Engineered Products, Thomas Products and Fluid Transfer Divisions. These changes were designed to streamline operations, improve organizational efficiencies and create greater focus on customer needs.

CEO's Comments Regarding Results

"We were encouraged that the rate of decline in demand for our Industrial Products appeared to stabilize during the first quarter of 2009," said Barry L. Pennypacker, Gardner Denver's President and CEO. "For the quarter, orders in this group were less than the first quarter of 2008 in all major product lines but generally consistent with the order rates we experienced in the latter part of the fourth quarter of 2008. We experienced some order cancellations, particularly in products sold for printing applications, as our customers reassessed their demand forecasts."

Outlook

Commenting on the global demand environment, Mr. Pennypacker stated, "Our limited visibility into future demand trends in key end market segments creates an unusual level of uncertainty and variability in our financial outlook. Orders for our products serving industrial end market segments remained weak in the first quarter, especially in the U.S. and Europe. Demand for these products tends to correlate with the level of manufacturing capacity utilization. The continued contraction in capacity utilization in the U.S. and Europe has resulted in declining demand for capital equipment such as blowers and compressor packages. As a result of our expectation for ongoing weak economic conditions, we anticipate demand for industrial products to remain relatively low for the remainder of 2009, and we remain cautious in our outlook. When demand begins to recover, we expect to initially see increased orders for aftermarket parts and shorter lead-time products that are more susceptible to swings in the economy, such as those that serve light industry and Class 8 trucks and OEM products for medical and environmental applications. At this point, we have not yet seen signs of that demand improving.

WALL STREET WATCH

"Revenues for Engineered Products depend more on existing backlog levels than revenues for Industrial Products. Although we expect orders for Engineered Products to decline through the balance of 2009, shipments from current backlog provide slightly better visibility than exists in our outlook for Industrial Products.

"Orders for petroleum and industrial pumps continued to fall in the first quarter as a result of declining energy prices and the related reduction in rig count in North America. We expect revenues for this business unit to decline through the balance of the year and at present, we are uncertain how long petroleum pump orders will remain at these depressed levels. However, management has identified opportunities to increase aftermarket sales, which could help mitigate the lower demand for new pumps.

"We continue to streamline our organizational structure and reduce costs as we execute business process improvements identified through the implementation of the Gardner Denver Way. We expect to record profit improvement charges of $9 million in the second quarter and $17 million in the second half of 2009 for these cost reduction initiatives. The cost of these projects does not reflect the potential receipt of government-funded incentives to facilitate the relocation of equipment and personnel and employee training and development."

Hamilton, Bermuda, April 22, 2009 — Ingersoll-Rand Company Limited (NYSE:IR), the world leader in creating and sustaining safe, comfortable and energy efficient environments, today announced that total reported revenues increased by 36% for the first quarter of 2009 compared with the 2008 first quarter and EPS from continuing operations exceeded revised guidance.

The company reported a net loss of $26.7 million, or diluted earnings per share (DEPS) of $(0.08), for the first quarter of 2009. First-quarter net loss included a loss of $20.4 million, or DEPS of $(0.06) from continuing operations, as well as $6.3 million of after tax costs, equal to DEPS of $(0.02) from discontinued operations. First-quarter earnings from continuing operations include approximately $11 million of pre-tax costs for restructuring. Excluding these restructuring costs, first quarter DEPS loss from continuing operations was $(0.04) per share.

Net earnings for the 2008 first quarter of $181.6 million, or DEPS of $0.66, included DEPS of $0.77 from continuing operations and DEPS of $(0.11) from discontinued operations, which represent discontinued businesses and the retained costs of divested businesses.

"Despite an unprecedented decline in volume across all of our businesses and regions, we delivered better-than-expected results compared with our most recent forecast as productivity and cost-reduction initiatives gained momentum throughout the quarter," said Herbert L. Henkel, chairman and CEO. "We managed our business to mitigate the adverse effects of current market conditions; we continued to position the company for long-term performance by investing in critical projects to drive innovation and customer satisfaction.

We improved liquidity through debt refinancing, and we continued managing for cash and delivering synergies related to our acquisition of Trane."

"We continue to streamline our organizational structure and reduce costs as we execute business process improvements identified through the implementation of the Gardner Denver Way."

— Barry L. Pennypacker, Gardner Denver's President and CEO

First-Quarter Business Review

Industrial Technologies is focused on providing solutions to enhance customers' industrial and energy efficiency and provides equipment and services for compressed air systems, tools, fluid power production and energy generation systems. Total revenues in the first quarter of $538 million decreased by approximately 28% (down by 23% excluding currency) compared with the first quarter of 2008. Air and Productivity revenues declined by 23% due to lower volumes in all geographic regions and the negative impact of currency translation. Revenues in the Americas decreased by 25% compared with last year due to declines in major industrial, process and fluid handling end markets. Air and Productivity Solutions revenues in Europe, Asia and India were down by approximately 21% (down by 12% excluding currency) compared with 2008 due to declining industrial activity. Club Car revenues declined by 45% compared with record results in the first quarter of 2008 due to weakening fundamentals in key golf, hospitality and recreation markets, especially in the United States. First-quarter operating margin for Industrial Technologies of 3.2% declined compared with 13.1% last year, due to lower volumes and unfavorable mix, which were partially offset by cost productivity and carryover pricing benefits. BP

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