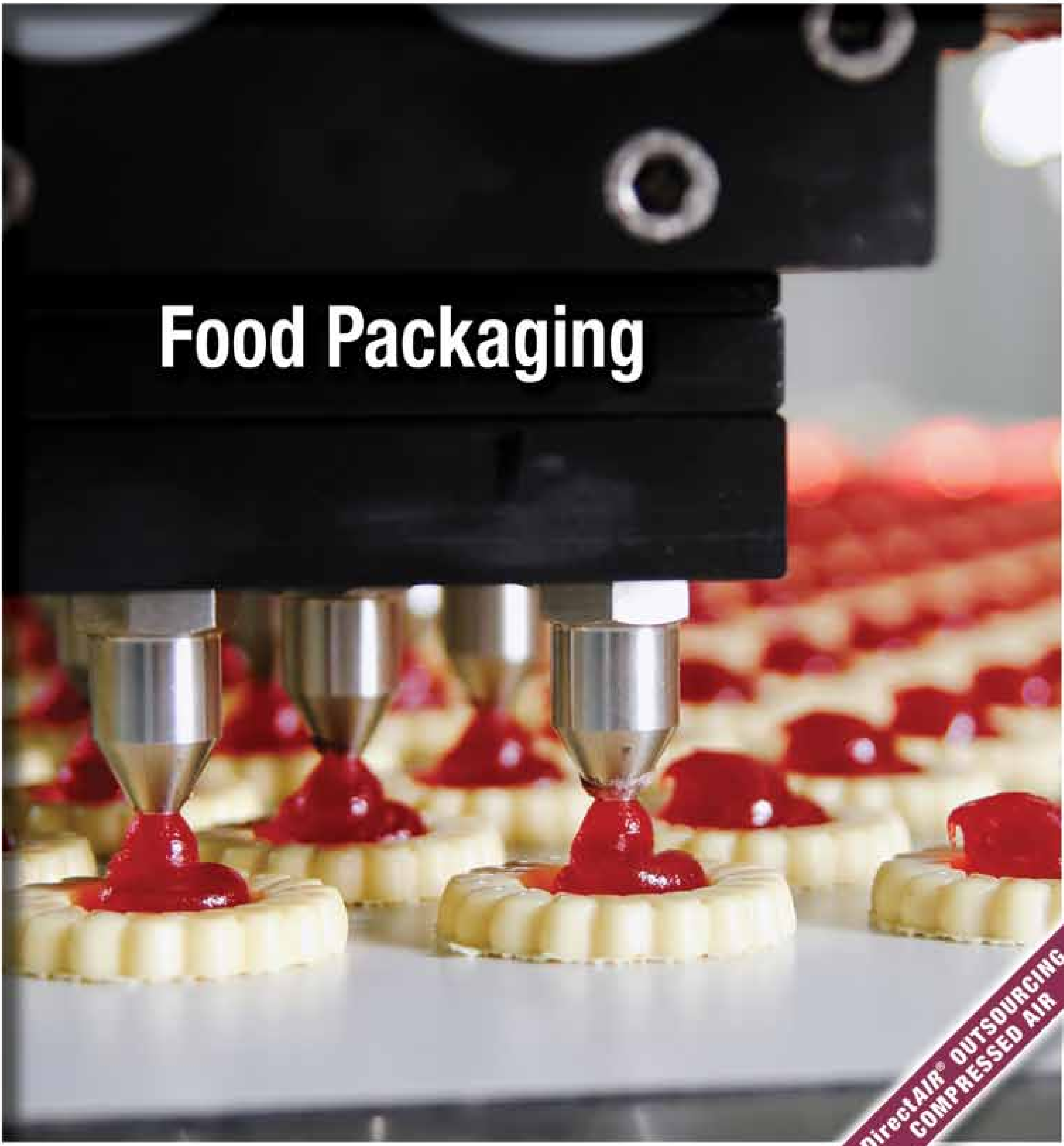
OEM Machine Design Optimizing Pneumatics Kroger Bakery Saves Energy

October 2010

COMPRESSED AIR BEST PRACTICES®



Atlas Copco Compressors: The Air Auditing Specialists.

Puzzled by rising energy costs?

Atlas Copco has a full range of compressed air auditing services available - from simple system diagnostics all the way to ultrasonic leak detection. These services are available for any compressed air system.

A compressed air audit from Atlas Copco will:

- Show your compressor's energy usage.
- Highlight areas where savings could be made.
- Provide you with a payback analysis on any new investments.
- Provide you with a professional audit report.

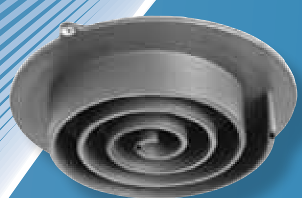
Call Us: 866-688-9611
Log On: www.atlascopco.us/mboxusa

Sustainable Productivity

Atlas Copco

HITACHI
Inspire the Next

SRL Series Oil-Free Air Compressors



Innovation

- World's Largest Scroll (7.5hp)
- Patented Labyrinth Lap for extended life and reliability
- Multi-Stage cooling for stable discharge temperatures
- Cycle Control Logic for Energy Savings and compressor protection

100% Oil-Less Design

- Highest Air Purity
- Environmentally Friendly
- Reduced consumables for maintenance

Superior Sound Quality

- Ultra low sound
- Full enclosure standard

Hitachi's history of success and proven experience in scroll technologies has enabled Worldwide Innovation of producing the World's First Scroll for air compression. With over 20+ years experience in scroll compression, the SRL Series of Oil Free Compressors represents our alignment of value for the discriminating air user.

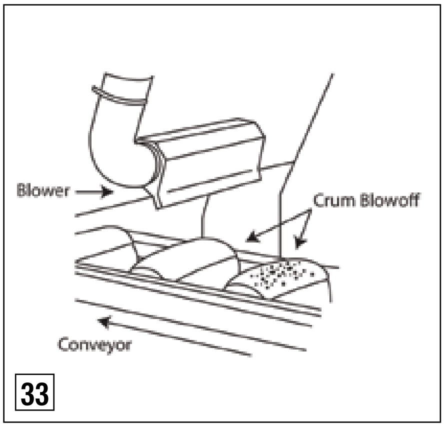
HITACHI AMERICA, LTD. AIR TECHNOLOGY GROUP
5808-Q Long Creek Park Drive, Suite Q; Charlotte, NC 28269
Tel: 704.494.3008 ext 28 www.hitachi-america.us/airtech; airtechinfo@hal.hitachi.com
Hitachi Industrial Equipment Systems Co., Ltd.

100th ANNIVERSARY
Celebrating 100 years of the Hitachi Group

HITACHI
Inspire the Next

SUSTAINABLE MANUFACTURING FEATURES

COLUMNS



FROM THE EDITOR

Food Packaging

What would happen if all food industry-related facilities were able to reduce their average operating pressure of compressed air by 20 psig? Using the good old rule of thumb of 1% efficiency gain for every 2 psi of pressure reduction, the industry would see an efficiency gain of 10%. More than one energy manager at major food industry corporations has stated this 20 psig average pressure reduction goal to me.

OEMs of food packaging equipment have a tremendous opportunity before them. They can offer their customers energy-efficient machines designed to operate at 70–80 psig. I spoke to one energy manager responsible for more than one hundred facilities who said, "The OEMs are our primary obstacle to reducing air pressure — if they had a premium machine, which operated at lower air pressures, it would be a good investment for our corporation." I do know of one "Top 10" packaging machine OEM who has taken that first step.

This edition provides several examples of common food industry energy optimization opportunities. They focus on *pneumatics* and on blowoff applications. *Pneumatics* are consistently found, by auditors, to create pressure losses and leaks due to inappropriate sizing. Blowoff applications can be optimized with either air amplifiers or blowers with air knives. As always, each situation is unique and must be analyzed on its own merits for the best solution.

On a separate note, I am personally pleased to announce our new collaboration with the 2011 Hannover Messe. To be held April 4–8, 2011, we have created a Compressed Air Best Practices® Pavilion in the ComVac Halle. The Pavilion will offer North American exhibitors a great value and opportunity to build their export business in Europe and Asia. For those who want to visit the fair, we have also organized a Customized Delegation Package, offering free fair passes, group dinners and trade contacts.

I can tell all that the Hannover Messe is *the one* can't-miss global industrial event. If you want to get ideas on how to reduce energy costs in your facility, this event is for you. If you want to find distributors for your products, this event may change the future of your company. I personally worked this show for more than ten years and speak from experience. I invite anyone interested to contact me directly.

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

ROD SMITH
Editor
NEW PHONE: 412-980-9901
rod@airbestpractices.com

"The Hannover Messe is the one can't-miss global industrial event. To be held April 4–8, 2011, we have created a Compressed Air Best Practices® Pavilion in the ComVac Halle."

— Rod Smith,
Compressed Air Best Practices®

SUSTAINABLE MANUFACTURING NEWS

Dean Foods, Graham Packaging, Pilgrim's Pride, Sealed Air

SOURCED FROM THE WEB

Dean Foods Targets 20% GHG Reduction

Dean Foods is the largest processor and distributor of dairy products in the United States. Today, Dean Foods Company accounts for approximately 35% of total milk sales in the United States. We have more than 100 manufacturing facilities located in 36 states, and 1 manufacturing facility in the United Kingdom.

We believe that there are opportunities throughout the business to be more energy efficient. We have set a goal to reduce our carbon footprint by 20% by 2013. We plan to achieve this reduction through energy-efficiency initiatives, renewable energy investments and industry collaborations.

In 2007, we compiled our first comprehensive greenhouse gas inventory consistent with the principles and guidance of the World Resources Institute's Greenhouse Gas Protocol. Since then, we have submitted overall data for our 2006 and 2007 emissions to the Carbon Disclosure Project (CDP) and facility-level data for our California operations to the California Climate Action Registry. We plan to continue providing data to the CDP. We will report our 2009 carbon footprint to the Climate Registry in 2010.

For our initial footprint, we chose to include emissions from operations that we operate and control. This includes the plants we operate across the United States, the trucks and trailers we operate nationwide and the two organic dairy farms we own and operate in Idaho and Maryland. We have not included: 1.) The upstream emissions associated with agricultural inputs and the packaging or products provided to us by third-party suppliers or 2.) The downstream emissions from third-party distributors and haulers of our products or from the retail stores where our products are sold.

Our total calculated annual emissions for 2007 were approximately 1.6 million metric tons of CO_2e (carbon dioxide equivalents), or 1.03 pounds per gallon of product produced. Our three largest sources of greenhouse gas (GHG) emissions are from:

We are committed to removing at least 200,000 metric tons of CO_2e by 2013 by replacing current amounts of purchased electricity and onsite fuel combustion with renewable or clean energy and reducing energy demands with investments in more energy-efficient equipment and machines.

- Purchased electricity and onsite fuel combustion to operate our plants (64%)
- Mobile fuel combustion and refrigerants to operate our trucks and trailers (32%)
- Our farms in Maryland and Idaho and waste treatment operations (4%)

Based on the work we completed in measuring and understanding our footprint, we have set a target to reduce our carbon emissions by 20% per gallon of product by 2013.

Our plant operations are the largest component of our carbon footprint. We are committed to removing at least 200,000 metric tons of CO_2e by 2013 by replacing current amounts of purchased electricity and onsite fuel combustion with renewable or clean energy and reducing energy demands with investments in more energy-efficient equipment and machines. To assist in achieving this goal, we have conducted energy audits at several of our larger manufacturing facilities. All of these audits have identified opportunities to reduce our use of electricity and fuel and resulting carbon emissions. Specific examples of projects we expect to implement in our facilities include:

- Converting biogas into energy
- Utilizing Cogeneration (CHP) plants as a viable, cleaner alternative to traditional energy sources
- Retrofitting/replacing inefficient equipment and lighting
- Adopting high-efficiency technology
- Upgrading insulation and reducing thermal loss
- Investing in methane recovery systems
- Recovering unused heating/cooling stream systems
- Installing state-of-the-art and real-time controls and software in our production facilities

Source: www.deanfoods.com

SUSTAINABLE MANUFACTURING NEWS

Dean Foods, Graham Packaging, Pilgrim's Pride, Sealed Air

"The space, weight and fuel savings accrue both to AriZona and to the environment. The consumer also gets a lighter bottle that's easier to handle."

— Mark Leiden,
Vice President of Global Marketing and PET Business Manager for Graham Packaging

Graham Packaging Reduces Carbon Footprint

What do you call a truckload of improved PET bottles that weighs half a ton less than before, yet contains 7,650 bottles more? Answer: A much improved carbon footprint.

AriZona Iced Tea is getting the benefit of that improved carbon footprint from Graham Packaging's new Slingshot™ proprietary lightweight barrier PET bottle, which is currently being introduced in markets across the country as an upgrade for the AriZona Iced Tea 16-ounce bottle.

Mark Leiden, vice president of global marketing and PET business manager for Graham Packaging (NYSE: GRM), said the Slingshot bottle is 20% lighter than AriZona Iced Tea's old bottle, and packs nearly 350 more bottles to a pallet. "That translates into a truckload that carries more than 7,650 additional bottles, yet weighs more than a thousand pounds less," Leiden said. "The space, weight and fuel savings accrue both to AriZona and to the environment. The consumer also gets a lighter bottle that's easier to handle."

Based on the production volume estimated for the new bottle and the savings in material to make the bottle and fuel to transport it, the reduction in carbon dioxide equivalents is significant — a reduction of more than 3.3 million pounds per year, according to Leiden. "Our customers have made it clear that reducing the carbon footprint of their products is a real goal, not just something they give lip service to," he said. "Graham Packaging has responded by making a major commitment to improved sustainability."

Graham Packaging Company Inc. produces more than 20 billion container units annually at 80 plants in North America, Europe and South America, and had net sales of $2.27 billion in 2009. The company is a leading United States supplier of plastic containers for hot-fill juice and juice drinks, sports drinks, drinkable yogurt and smoothies, nutritional supplements, wide-mouth food, dressings, condiments and beers; the leading global supplier of plastic containers for yogurt drinks; a leading supplier of plastic containers for liquid fabric care products, dish care products and hard-surface cleaners; the leading supplier in the U.S., Canada and Brazil of one-quart/one-liter plastic motor oil containers and a leading supplier of bottles for personal care products.

SOURCE: www.grahampackaging.com

SULLAIR®

Always air. Always there.™

What the phrase "Always there" means to you.

"Always there" defines Sullair as a company greater than its products.
It represents our employees and our extensive distribution network.
It is the way we conduct business, assuring you of exceptional
service and support—24 hours a day, and 7 days a week.

Always there.

Sullair has established a strong, trusted brand name in the markets we serve. The Sullair brand promise of "*Always there*" is delivered through the services and customer experiences of our distribution partners.

Commitment.

Together, we are committed to help you improve your production efficiency and reduce operating costs by providing: • air audits • air systems best practices • complete after-sales support • training programs and • service maintenance agreements.

Our logo says it all.

For more than four decades, the Sullair logo has generated a deep impression of our customer-driven philosophy. It creates an emotional connection and trust in the benefits our products and services offered you through our worldwide distribution network.

The Sullair brand promise is best expressed in the statement:
"Always air. Always there."
It is the essence of our total value proposition.

Sullair Corporation, 3700 East Michigan Boulevard, Michigan City, IN 46360 • Telephone 1-219-879-5451 • www.sullair.com

SULLAIR®

Always air. Always there.™

SUSTAINABLE MANUFACTURING NEWS

Dean Foods, Graham Packaging, Pilgrim's Pride, Sealed Air

Pilgrim's Pride Targets 10% Efficiency Increase

Pilgrim's Pride is a Fortune 500 company with $8.5 billion in annual net sales and approximately 41,000 employees. The company has the capacity to process more than 9 billion pounds of poultry per year and exports to more than 80 countries.

Food production requires the use of water, land and air resources. Pilgrim's Pride Corporation understands that it's our responsibility to be a good steward of these resources, and we have implemented the Pilgrim's enviropride Sustainable Progress system to help accomplish this goal. This system serves as the environmental framework for our day-to-day operations and long-range planning.

Energy Goals:

1. Increase energy efficiency of processing/milling and rendering facilities by 10% by 2013.
2. Increase use of renewable energy sources by 5% by 2013.

Energy conservation is a key priority in our enviropride strategy. Our hatcheries, feed mills, processing plants, protein conversion plants and distribution centers all use significant amounts of electricity, natural gas and/or fuel oil. In order to manage our energy usage effectively, we have contracted with a major national firm to track our energy usage and manage our utility bills.

We are working to reduce our total energy dependence in a number of ways. We have conducted a company-wide energy efficiency assessment to help develop a comprehensive strategy for reducing energy consumption and environmental emissions. In just one of our facilities, we identified opportunities for a 14% reduction in energy consumption equivalent to $3.3 million in annual energy cost reductions.

As energy costs continue to soar, biofuels are gaining increasing importance as an alternative energy source. Our company is currently using poultry fat as a fuel source at two company locations, where it is used to heat water for our chicken-processing plants. The boilers at these locations have the ability to use natural gas, low-sulfur #2 heating oil or biofuel (poultry fat), and can use the most cost-effective source depending on market prices for these fuels.

While this is promising, biofuels are just one of the potential uses for recycled poultry by-products, which can take other forms, including ingredients for animal and pet feed. We currently sell about a million pounds of poultry fat per week to outside vendors who use the material to produce biofuel, while the remaining material is converted to fats and oils for feed rations.

In continuing to identify new ways to conserve energy, one of the technologies we have tapped is the use of heat-recovery systems in our protein recycling plants. Vapor from the cooking process is captured in a heat exchanger, which uses 280 °F steam to produce hot water. This process can provide up to 300,000 gallons of hot water to our processing operations each day.

We are currently researching the potential for firing boilers using wood waste, a sulfur-free fuel source with the potential to burn cleaner than natural gas. Our alternative energy team continues to study conservation, biofuels and solar energy in order to find new ways to apply energy-saving technology to our business.

Facilities Goals:

1. Increase energy efficiency at all existing support facility locations by 10% by 2013.
2. Achieve LEED Certification for all new construction after 2010.

Most of our facilities are of significant size and require a variety of materials for construction and maintenance. We are currently assessing all existing facilities for opportunities to minimize energy consumption and optimize the use of building materials that offer superior environmental benefits. All new facilities will be evaluated and constructed to achieve LEED Certification by 2010. The Leadership in Energy and Environmental Design (LEED) Green Building Rating System™ encourages and accelerates global adoption of sustainable green building and development practices through the creation and implementation of universally understood and accepted tools and performance criteria.

Our World Headquarters Park office building, which opened in 2005, was designed to conserve energy and minimize environmental impact. It features an air conditioning system that uses chilled water instead of chemicals, with a variable-frequency drive that adjusts amperage for energy savings. Other energy-saving enhancements include windows that are double-paned and double-coated, and motion detectors that turn off lights when an office is vacated.

Source: www.pilgrimspride.com

Sealed Air Establishes Energy Goals

Sealed Air measures environmental goals in three areas — materials efficiency, energy efficiency and carbon efficiency. In this section, we've outlined what we are doing to achieve these goals in our own manufacturing operations.

Investing in production equipment efficiency, maximizing our use of raw materials and natural resources and maintaining a safe and healthy workplace are the cornerstones of Sealed Air's Environmental Health & Safety initiatives. We have set public goals and regularly report progress against them.

- Reduce waste — find practical uses for 96% of our raw materials by the end of 2010
- Reduce GHG emissions by 12% between 2006 and 2010
- Reduce energy intensity by 2% between 2006 and 2010
- Increase the use of alternative energy
- Maintain a safe working environment

Sealed Air operated more than 100 manufacturing facilities worldwide and had revenues of $4.2 billion in 2009. BP

Source: www.cryovac.com

THE SYSTEM ASSESSMENT OF THE MONTH

Prepared Food Plant Manages Leaks and Blowoffs

BY HANK VAN ORMER, AIR POWER USA

Introduction

This Midwestern prepared food company now spends $269,463 annually on energy to operate their compressed air system. This figure will increase as electric rates are raised from their current average of 6.2 cents per kWh. The set of projects recommended below will reduce these energy costs by $112,902, or 41%. In addition, these projects will enhance productivity and quality and reduce equipment maintenance costs. Estimated costs for completing the projects total $146,102, which represents a simple payback of 15.6 months.

This plant produces prepared foods, which are frozen and then shipped for distribution. The production is vertical, as meals are cooked and prepared onsite. The plant runs production six days a week, with limited or no production on Sundays. Some cleanup and maintenance is implemented on Sundays, however. Due to space constraints in this article, we will focus only on the demand-side system opportunities to realize energy savings that were found.

Demand-Side System Projects

Please note that all the demand-side system optimizations listed in this article *only became realized energy savings because we completely modified the capacity control strategy on the air compressors.* Compressors were manually turned on and off by maintenance personnel and without this change, the actions below would have yielded $0 in savings. It's important that customers understand that demand-side actions, without the accompanying investments in control strategies, may not yield any results.

Demand-side projects described in this article include a leak management program, reconfiguring cabinet coolers and replacing open blows.

	SAVINGS	AVG KW	KWH	SAVINGS	COST
DEMAND-SIDE SYSTEM					
1. Implement ongoing leak management program	195 acfm	16.56 kW	145,065 kWh	$8,991	$2,050
POTENTIALLY INAPPROPRIATE AIR USES					
2. Reconfigure cabinet coolers in 9A and 0B CIP with automatic controls. MPO Oven Area	26 acfm	2.2 kW	19,272 kWh	$1,199	$1,000
3. Replace open blows per attached list with appropriate venture amplifiers or mechanical substitutes	324 acfm	27.51 kW	240,981 kWh	$14,940	$2,200
4. Replace air vibrators with electric units 2 — Semolina Room 4 — Extruders — One unit is down for repair	16 acfm	1.4 kW	12,264 kWh	$602	$2,700
5. Install low-pressure air to re place or reduce high-pressure air — install liquid flow inducer in three agitation tanks in lieu of air jets	100 acfm	8.49 kW	74,372 kWh	$4,611	$3,000
6. Remove cooling air for 23 taps on 25 electric motors in palletizing and palletizing annex.	230 acfm	19.53 kW	171,084 kWh	$10,605	$2,300

THE SYSTEM ASSESSMENT OF THE MONTH

Prepared Food Plant Manages Leaks and Blowoffs

Compressed Air Leak Survey

A survey of compressed air leaks was conducted at the plant, and 41 leaks were identified, quantified, located and listed. Potential savings totaled 195 cfm for the 41 leaks that were identified.

Ultrasonic leak locators were used to identify and quantify the compressed air leaks. These tools included a VXP AccuTrak manufactured by Superior Signal, and a UE Systems Ultraprobe 2000. Estimation of leak size was achieved by noting the intensity of the signal by the operator, the type of leak and observation. The estimates were made on a conservative basis and probably understate the magnitude of the volume of leaks. The results of the leak survey are summarized and tabulated on this page.

Shutting off the air supply to these leaks when the area is idle would save significant energy use. Reducing the overall system pressure would also reduce the impact of the leaks, when air to the air cannot be shut off. Repairing the leaks can save additional energy. The savings estimates associated with a leak management program are based on the unloading controls of the compressors being able to effectively translate less air flow into lower cost.

With a few minor exceptions, most of the leaks could not have been found without the use of an ultrasonic leak detector and a trained operator. Leak locating during production time with the proper equipment is very effective, and often shows leaks that are not there when production is idle.

However, a regular program of inspecting the systems in "off hours" with "air powered up" is also a good idea. In a system such as this one, some 90–95% of the total leaks will be found in the use of the machinery, not in the distribution system.

The area surveyed in the leak study included a great deal of high background noise from steam leaks, which shielded many of the smaller leaks. In continuing the leak management program, plant staff should perform leak detection during non-production hours in order to eliminate some of the high ultrasonic background noise.

TABLE 1: LEAK SURVEY RESULTS

NO	LOCATION	DESCRIPTION	EST SIZE	EST CFM
1	Line 5 Caser	Regulator	M	5
2	"	In area of Reg	M	5
3	"	"	S	2
4	"	"	M	5
5	Pot Station	Cylinder on Lift	L	10
6	"	"	L	10
7	Pot Station Pan	Washer Filter Drain	M	5
8	Rack Washer	Pin Holes in Hose Near	M	5
9	Line 1A Metal detect	Comp Fit	M	5
10	"	Compressor Fit	M	5
11	Line 2 Horse Shoe	Fitting Build Col drop	M	5
12	Blancher A Discharge	Drain Filter Air Bar	L	10
13	Blancher A Incline	Hole in Hose Air Bar	M	5
14	Steamer Cabinet Air	Outer Lock Reg	M	5
15	"	"	M	5
16	"	"	M	5
17	Extruder C Feed Platform	Regulator/ Filter	M	5
18	CIP 5 Rinse Tank Valve	Loose Line	M	5
19	CIP 5 Panel	Near Panel Could	M	5
20	CIP 9A-9B Miller Filter	Seal Filter	M	5
21	Next to Cab Cooler	Union	M	5
22	Cabinet 10 Merzan Tom.	Valve Bank	M	5
23	"	Filter Drains not Seal	S	2
24	AVF 3 & 4 Line 2 Above	Regulator/ Filter	M	2
25	Line 5 West End Cook	Top of Filter	S	2
26	Line10 (old line 9)	Inside Butter Cutter ID 40737	M	2
27	Line1A Tray Drop	Top of Filter	L	10
28	Douglas Packer	Inside Unit	S	2
29	Douglas Packer	Inside Unit	M	5
30	"	"	M	5
31	"	"	M	5
32	"	"	M	5
33	"	"	S	2
34	"	"	S	2
35	"	"	S	2
36	"	"	S	2
37	Palletizer # 2 Top	Cylinder on One Side of Stroke	M	5
38	9-10 Case Packing	Overhead Leak	M	5
39	Out from Leak 38 on Conveyor	Above	M	5
40	Next to # 39 Leak on Wall	Overhead Leak	M	5
41	Palletizer #10 West End Load	Tubing Connection	M	5
			TOTAL	**195**

✔ **RECOMMENDED PROJECT (#1) –** Implement ongoing leak identification and repair program with ultrasonic locators. (See Leak List)

Estimated reduction of air flow with proposed project	195 cfm
Recoverable savings from air flow reduction [Section 2.3]	$46.11/cfm year
Annual electric cost savings with proposed project	$8,991/year
Cost of leak detection equipment	Plant owns Ultraprobe
Unit cost of leak repairs ($15 materials per leak and $35 labor per leak)	$50
Total project cost (materials and installation for 41 leaks)	$2,050

4.7.1 Cabinet Coolers

Cabinet cooling is often required to obtain reasonable life and performance of the electronic equipment in control cabinets. Blowing straight compressed air into the cabinet for cooling is generally not an efficient or cost-effective use of compressed air. Vortex coolers deliver chilled air with no moving parts, and therefore may use less compressed air when properly applied. Vortex coolers should always be:

- Regulated to the lower effective pressure
- Equipped with a flow generator set to the lowest effective flow
- Equipped with automatic temperature-controlled shutoffs

Refrigeration units should be carefully selected and equipped with automatic regulation control.

THE SYSTEM ASSESSMENT OF THE MONTH

Prepared Food Plant Manages Leaks and Blowoffs

Most plants can benefit from an ongoing demand-side monitoring and leak management program. Generally speaking, the most effective programs are those that involve the production supervisors and operators working in concert with the maintenance personnel.

Alternatives to using compressed air for cabinet cooling include "heat tubes" or "heat pipes," whose cores are made from highly conductive alloy materials for fluid cooling. In operation, the heat flows from the outside by means of a fluid phase change. As heat is applied to the core (inside the cabinet), the fluid inside the pipe absorbs heat, is vaporized and then travels to the condenser end (outside the cabinet), where it is cooled back to a liquid. The liquid then returns to the evaporator inside the cabinet, etc. An exterior fan usually draws heat away from the core, which cools the internal cabinet without exposing the interior of the cabinet to ambient air.

Heat tubes are most energy efficient when applied to cool a "sealed cabinet." The only mechanical parts are the fans — heat pipes are passive and require no power — they cannot cool below ambient temperature unless water-cooled.

Another very effective cooler that **can** cool below ambient when the heat load is within its capability is a Thermoelectric Air Conditioner, which uses the "Pelletier effect" to convert low electric flow into **refrigeration**.

Current Situation:

The following table lists some observed cabinet coolers that require installation modification. In this case, we are suggesting automatic temperature control shut offs.

TABLE 2: CABINET COOLERS

CABINET COOLERS IN PLANT:					
LOCATION	SIZE (CFM)	QTY	UTILIZATION %	RECOMMEND	SAVINGS (NET AVG. CFM)
MPO Oven Area	20	1	80%	Temp Control	8
CIP System 9A	20	1	100%	Temp Control	10
CIP System 9B	20	1	50%	—	—
MPO Oven Area	20	1	80%	Temp Control	8

✔ **RECOMMENDED PROJECT (#2)** — Reconfigure cabinet coolers; add automatic temperature control.

Estimated reduction in air flow for all coolers	26 cfm
Recoverable savings from air flow reduction [Section 2.3]	$46.11/cfm year
Annual electric cost savings with proposed project (gross)	$1,199/year
Project cost (materials and installation)	$1,000

Replace Blowoff Air with Amplifier Nozzles

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

- Use high pressure only as a last resort
- All blowoff air should be regulated
- All blowoff 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 blowoff air by at least 50%, freeing up more air flow for other applications
- All blowoff air should be shut off (automatically) when not needed for production

Plants with many ⅛" and ¼" lines running as blowoff 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 mix it directly into the air stream, 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 blowoff air to the process and generate a savings of 15 cfm of compressed air per ¼" blowoff. Savings may be available using ⅛" lines, but the cost effectiveness will not be as great.

Another method to be investigated for blowoff is the use of "blower generated" low- pressure air. This air is much less costly to produce on a $/scfm basis. It is the volume of air (scfm) that creates the mass or weight of the air that performs the blowoff. 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 blowoff over the higher-pressure version.

✔ **RECOMMENDED PROJECT (#3)** — Replace 17 open blows with air amplifiers nozzles.

Total air flow reduction	324 cfm
Recoverable savings from air flow reduction	$46.11/cfm year
Total annual electric savings	$14,940/year
Total nozzle cost (materials and installation of 22 new nozzles)	$2,200

THE SYSTEM ASSESSMENT OF THE MONTH

Prepared Food Plant Manages Leaks and Blowoffs

TABLE 3: LIST OF BLOWOFF LOCATIONS

	LOCATION	SIZE	CFM USAGE	UTILIZATION	CFM USAGE AS APPLIED	TIMED CHANGE IN UTILIZATION	EST. SAVINGS CFM NOZZLE	EST. SAVINGS CFM TIMED	NOZZLE	EST. USAGE CFM
1	Blancher A	⅜"	20	80	16	—	8	—	Adj	8
2	Blancher A	⅜"	20	80	16	—	8	—	Adj	8
3	Line 1	Windjet	30	30	10	—	10 (remove)	—	—	0
4	Cookstand	—	—	—	—	—	—	—	—	
5	Extender C	Windjet	30	80	24	—	12	—	Adj	12
6	Extruder B	Bar	40	50	20	—	0	—	Wedge	0
7	Extruder B	Bar	40	50	20	—	0	—	Wedge	0
8	Blancher B	Bar	40	50	20	—	0	—	Wedge	0
9	Blancher C	Bar	40	50	20	—	0	—	Wedge	0
10	Line 6 Boxformer A	¼"	20	80	16	—	8	—	¼"	8
11	Line 6 Boxformer B	¼"	20	80	16	—	8	—	¼"	8
12	Line 6 Boxformer B	Windjet	30	80	24	—	12	—	Wedge	12
13	Line 7 Packaging	(2) ¼"	40	80	32	—	16	—	¼"	16
14	ASI Work Station 7	(2) ¼"	40	80	32	—	16	—	¼"	16
15	Line 8 Tray Drop	18" Airknife	54	75	40	—	40	—	Adjust grinder to slow tray or other mechanical device	0
16	Line 1A	Bar	40	75	30	—	30	—	—	—
17	Line 1B	Bar	40	75	30	—	30	—	—	—
18	Line 9 Casing	Windjet	30	75	22	—	11	—	Wedge	11
19	Line 9 Casing	Windjet	30	75	22	—	11	—	Wedge	0
20	Blancher A	12" AX	36	75	27	—	27	—	Adjust grinder to slow tray or other mechanical device	0
21	Blancher A	12" AX	36	75	27	—	27	—	—	—
22	Blancher A Infeed	Bar	40	50	20	—	10	—	Wedge	20
TOTAL Estimated Usage = 324										**210**

Summary

Most plants can benefit from an ongoing demand-side monitoring and leak management program. Generally speaking, the most effective programs are those that involve the production supervisors and operators working in concert with the maintenance personnel. Accordingly, it is suggested that all programs consist of the following:

- Short Term – Set up a continuing leak inspection by maintenance personnel so that for a while, each primary sector of the plant is inspected once each quarter to identify and repair leaks. A record should be kept of all findings, corrective measures and overall results.
- Long Term – Consider setting up programs to motivate the operators and supervisors to identify and repair leaks and to continue monitoring blowoffs, cabinet coolers and other potentially inappropriate uses of compressed air. One method that has worked well for many operations is to monitor the air flow to each department and make each department responsible for identifying its air usage as a measurable part of the operating expense for that area. This usually works best when combined with an effective in-house training, awareness and incentive program. BP

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

The savings estimates associated with a leak management program are based on the unloading controls of the compressors being able to effectively translate less air flow into lower cost.

Energy-Saving Opportunities in Blowoff Applications

Assessing payback on engineered air nozzle and blower upgrades

BY TED CLAYTON, KAMAN INDUSTRIAL TECHNOLOGIES

Background

There are a variety of means factories can use to remove or "blowoff" moisture from a package. Open tubes or drilled pipe are often viewed as simple low-cost methods. However, there are considerable drawbacks to these approaches, most notably — increased operating expense. While they may be convenient and inexpensive in the short term, these approaches often cost 5–7 times more to operate than preferred alternatives. Additionally, they can raise safety concerns for dead-ended pressure and ambient noise requirements in order to comply with OSHA guidelines.

Energy savings are often overlooked in many blowoff applications.

Beyond the obvious disadvantages with these makeshift components themselves, leaders in the energy conservation field have long advocated that users "take the system approach" to fully optimizes the combined total use of energy. At one extreme, a system that is perfectly efficient yet runs when there is no useful work being done is wasting 100% of the energy it consumes. However more commonly, there can be a single element in the system that can be improved for significant energy savings. The good news is that whether you are able to implement a total system reengineering project or are just looking for a quick fix, opportunities abound in many blowoff applications.

Engineered air nozzles offer simple but valuable energy-savings opportunities.

A Bird in the Hand

In the food and beverage industry particularly, many leading organizations are moving their blowoff applications from compressed air to low pressure, high volume blowers that offer lower operating costs. It can be exciting to consider the latest innovation and understanding the impact of new technology is important in planning future operations. However, be careful not to allow the promise of new technology to distract you from optimizing your current operations.

While there is often a clear winner in terms of energy performance, there is also a corresponding cost to achieve that performance. The costs must always be weighed against the benefits. Don't allow commitment to an ideal solution to delay meaningful and immediate progress that can be made in smaller steps.

For example, one of the most commonly missed opportunities is the Turn-it-Off principle — a powerful tactic that has yet to achieve its fullest use. There are a number of ways to capture the benefits of Turn-it-Off, either by adopting the practice literally or by incorporating a more automated solution such as an electronic flow control.

As Theodore Roosevelt said "do what you can, with what you have, where you are." If you have options to improve your existing operations — you should take them. Many organizations have yet to take advantage of low cost options that significantly reduce costs and energy use while holding out for a preferred ideal solution.

Different Priorities

A manufacturing plant can be thought of in terms of two halves — the basic facility infrastructure (plumbing, electrical service, HVAC and compressed air) and the manufacturing equipment purchased from various OEMs and machine builders.

The plant's priorities include reliability, operational efficiency, cost of maintenance, etc. This responsibility creates a detailed understanding of the facility infrastructure half of the compressed air system: the compressors, dryers, receivers, controls/sequencers, piping, etc. However, the components and equipment that uses the compressed air: air knives, cylinders, actuators, coolers, vacuum generators, etc. — are often designed, specified and supplied by the machine builder with little input from the end user of the equipment. The priority here is process reliability, production throughput and quality — in other words, performance not economy.

While energy use is a growing consideration in machine design these days, the detailed understanding of key performance criteria is rarely known outside of the machine builder's engineering department. Unless the end user specification addresses energy consumption, standard efficient components are frequently supplied. Once the production equipment arrives at the plant, the emphasis for up-time and production takes over and the associated costs to operate the equipment are generally accepted as fact.

It's only natural that cost reductions would be secondary to generating revenue, just as losses are secondary to profits in the scorecard of business — the Profit and Loss statement. At the same time, reducing operating cost is part of maximizing bottom line profits. Companies that achieve industry-leading performance are able to optimize both sides of the profit and loss equation to yield maximum bottom line results.

ENERGY SAVING OPPORTUNITIES IN BLOWOFF APPLICATIONS

Specify High-Efficiency Components

A key principle for energy intensive equipment is to specify the highest available efficiency of each component of the system. Energy is often the largest factor in Total Cost of Ownership. It can be as high as 96% for electric motors and for compressed air systems; energy is often cited at 82% of lifetime costs. While this may be a more expensive choice initially, utilizing this strategy will maximize overall system efficiency and provide lower operational cost over the long run.

Again, it's important to take a practical and balanced approach. Is there an opportunity to plan an organized system evolution incorporating next generation technology updates throughout the plant? Or is there anything that can be done with the existing machinery to improve efficiency in the near term? Many simple, short-term solutions have payback periods of just one or two months. Don't overlook this low-hanging fruit while you're busy mapping out your long-term strategy.

Let's explore two scenarios for the same process application — blowoffs on a bottling line — to illustrate some of the details. One option is to upgrade the compressed air design to utilize a higher efficiency nozzle and reduce compressed air demand. The other option is to eliminate the use of compressed air and change over the system to blower-based equipment with lower overall costs.

Scenario A: Compressed Air Nozzle Upgrade

Often, the use of compressed air requires a nozzle to properly shape the air stream for the application. There are a variety of nozzles on the market — each with different performance in terms of force, air consumption and how much noise they produce.

As you are working to minimize the compressed air demand in your operation, make note of the types of nozzles in use in your facility and confirm they are providing optimum process and energy performance. Unfortunately, there are no standards to rely on here — you need to verify performance and look for higher efficiency alternatives. Look to your distributor for assistance in making specific comparisons. You may find good opportunity to reduce air demand, noise and operating costs.

Make the Most of What You Have

I recently worked with a beverage company to examine compressed air usage in their bottling operations. In one bottling line, the following applications were all utilizing standard air nozzles:

STANDARD AIR NOZZLES

APPLICATION	QTY	SCFM @ 80 PSI	TOTAL SCFM
Cap feeder	3	30	90
Blowoff after capper	6	25	150
Blowoff before labeler	6	25	150
Blowoff after sanitizer	2	25	50
Total of 17 devices using **440 scfm** of air.			

Though effective at removing moisture, the standard nozzles use a considerable amount of compressed air. Given that this air flow is on continuously, the annual operating costs are considerable. Assuming a cost of $0.25/1000 scfm and a plant that operates 24x5x50, the air costs for this line alone total $39,600 annually.

The suggested short-term alternative outlined below blends compressed air with ambient air to reduce the total demand and consumption of compressed air while still meeting the performance requirements of the application. These alternative devices are sometimes referred to as venturi, air amplification or engineered nozzles.

ENGINEERED AIR NOZZLES:

APPLICATION	QTY	SCFM @ 80 PSI	TOTAL SCFM
Cap feeder	3	14	42
Blowoff after capper	12" air knife	34.8	34.8
Blowoff before labeler	12" air knife	34.8	34.8
Blowoff after sanitizer	2	22	44
Total of 7 devices using **155.6 scfm** of air.			

Selecting engineered nozzles reduces the compressed air requirement by 284.4 scfm or 64.6%. Assuming the same costs and annual operating hours, these air savings are worth $25,596 per bottling line, while the costs for the upgrades in this example are just $2,016.

Payback in this upgrade scenario happens very quickly — in just one month the operational savings have completely covered the hardware costs. Given that the change utilizes existing piping, the installation costs are minimal. Simply swapping these devices for the original standard efficient ones is all it takes to implement this upgrade.

Scenario B: Upgrade to Blower-Based Technology

Low Pressure Air Design

If a new line is being designed, there is a growing preference to use low pressure, high volume air for blowoff applications, i.e. regenerative blowers.

A regenerative blower is a motor powered high volume, low pressure air supply that is suitable for many blowoff applications. A design using regen blowers for the cap feeder and blowoff application example given previously delivers maximum compressed air savings by completely eliminating its use in these applications. In this scenario, a blower rated 175 scfm @ 4 psi is used in the cap feeder application and another blower rated 300 scfm @ 3.5 psi is used for the blowoff applications.

This system achieves the greatest savings of compressed air but requires a more involved installation since a greater number of equipment modifications are needed. Note, this solution adds additional motor driven equipment that requires electricity to operate. For the purpose of comparison, this cost will be expressed in terms of the equivalent compressed air — or 72 cfm. So, although the solution eliminates the compressed air entirely, we will subtract the 72 cfm from the 440 cfm and show the savings as 368 cfm as a "net savings".

COMPARING THE ALTERNATIVES

	ENGINEERED NOZZLES	REGENERATIVE BLOWERS
COMPRESSED AIR SAVINGS	284.4 scfm	368 scfm
SAVINGS VALUE	$25,596/yr	$33,120/YR
HARDWARE COSTS	$2,016	$16,700
PAYBACK	0.95 months	6.05 Months
RELATIVE SAVINGS	77.3%	—
RELATIVE COSTS	12.1%	—

The chart above baselines the project for a single bottling line. For a facility with four bottling lines the total savings range from $102,384 to $132,480 per year. Each option is a good project, providing meaningful savings with attractive paybacks. Which is the right one for your organization?

Upgrading your compressed air blowoffs has the advantage of lower hardware and installation costs, but it doesn't completely eliminate the use of compressed air in applications with high run hours. However, this approach does squeeze additional performance from existing equipment and may make sense if you are not in a position to implement an immediate system overhaul.

Migrating from compressed air to blower driven equipment achieves the greatest savings but requires a larger hardware investment and a more involved installation. If the timing is right to leave compressed air behind in your blowoff applications, know that you'll be achieving a higher level of efficiency as you migrate to blower based solutions.

Regardless of which approach you prefer, consider the total impact. How many lines do you operate? Larger manufacturers operating a network of facilities will often have fleets of existing machinery of similar or even redundant designs. Estimate your total saving potential with either of these options for a single production line or across your total network. It is likely you have an opportunity to achieve meaningful cost and energy savings and do so with a rapid payback.

Don't delay — get started now! BP

Regenerative blowers eliminate the need for compressed air all together.

For more information please contact Ted Clayton, Marketing Manager, Energy and Power Management Services, Kaman Industrial Technologies, ted.clayton@kaman.com, Tel: 800-526-2626, www.kamandirect.com.

Ted Clayton has over 20 years of experience in engineered and applied product sales with an emphasis on value-based solutions. Ted's experience working at all levels of manufacturing organizations allows him to define economic value and frame technical solutions that bring meaningful cost reductions in an area of prime importance to a wide variety of industries.

OEM Machine Design

3 ENERGY-INEFFICIENT OEM Design Philosophies

1. Size of components
2. Cost of components
3. Workability of the application

Pneumatics: Sizing Demand Users

BY SCOT FOSS, AIR'S A GAS INC.

Most systems are sized on the supply-side at many times more volume and significantly higher pressure than is actually necessary to support the real demand, plus a fudge factor generally created out of fear. I am sure that had the OEM defined what is not only minimally necessary in terms of mass flow at density (pressure and temperature), but also with the intent of the highest possible efficiency, we would approach things very differently. Unfortunately, what drives the design and arrangement generally involves three goals for the OEM:

- **a.** Size of components
- **b.** Cost of components
- **c.** Workability of the application

To provide an example of what happens, most systems are diagnosed as having at least some undersized piping. Whenever I begin an audit, the client usually tells me that the system's piping is old and has never been reevaluated. When I ask how he or she knows that the system is undersized, I generally get a somewhat similar answer — that there is an air user at the far end of the system that cannot hold pressure. I am told that when the supply system is at 100 psig, the user can't hold 85 psig. When I ask the client how he knows that he needs 85 psig and where, I am generally told that 85 psig is the right number because the application doesn't work below 85, and he needs 85 at the gauge at the application. Let's look at the application arrangement illustration #1 on the next page.

Please note that the gauge pressure is being read at the downstream side of the regulator and the upstream side of the hose, hose fittings and, generally, the lubricator. When the application is static or off, the pressure read is the same as the supply pressure, assuming leaks are minimal. When the application is activated, the gauge pressure reflects the differential across the filter including dirt loading on the filter element plus the delta pressure on the regulator. In most cases the total differential equals what is believed to be the differential across the piping. If we changed the piping, there would be no material impact on the supply pressure to the user, perhaps 1–2 psig. The bulk of the delta is across the filter/regulator. The application probably has 10–15 psid across the hose, hose fittings and the lubricator. This means that the article pressure at mass flow is <70 psig. You can confirm this with either a needle gauge or a "T" and female Pete's Plug with a gauge in it located at the air user inlet. You can also use two pressure transducers, one at the discharge from the compressor room and one at the gauge port on the upstream side of the regulator plus a local gauge on the downstream side of the regulator. You can also install another analog gauge at the artificial pressure location in a female Pete's Plug. Please keep in mind that most analog gauges are cheap and can be off by as much as 6–7 psig. Make sure they are "calabrateable" and are field tested for accuracy.

Obviously, resizing the components to a total of 10 psid makes more sense than jacking up the system by 10–20 psig. Unfortunately, quick and inappropriate decisions are made by many maintenance personnel to simply elevate the system's pressure as much as possible over time. One of the problems with jacking up the supply pressure is that as the pressure rises, the demand flow on unregulated demand increases proportionately. The differential pressure increases as a square function of flow change. The result will provide a diminishing return as you jack up the pressure on all unregulated flows, including the point-of-use applications with regulators that are wide open and waste such as leaks. In most plants, we find that 80% of all point-of-use applications have regulators that are wide open, providing little more than a minimum delta pressure for the application. If the compressors are adjusted to modulate, jacking up the pressure using the subtractive pilot or cash acme valve will simply reduce the capacity of the compressor while increasing the total systems demand and reducing the article pressures in the plant. The increased flow will also increase the delta pressure across the piping and supply components. The result is that your cost will rise, the supply will

OEM MACHINE DESIGN

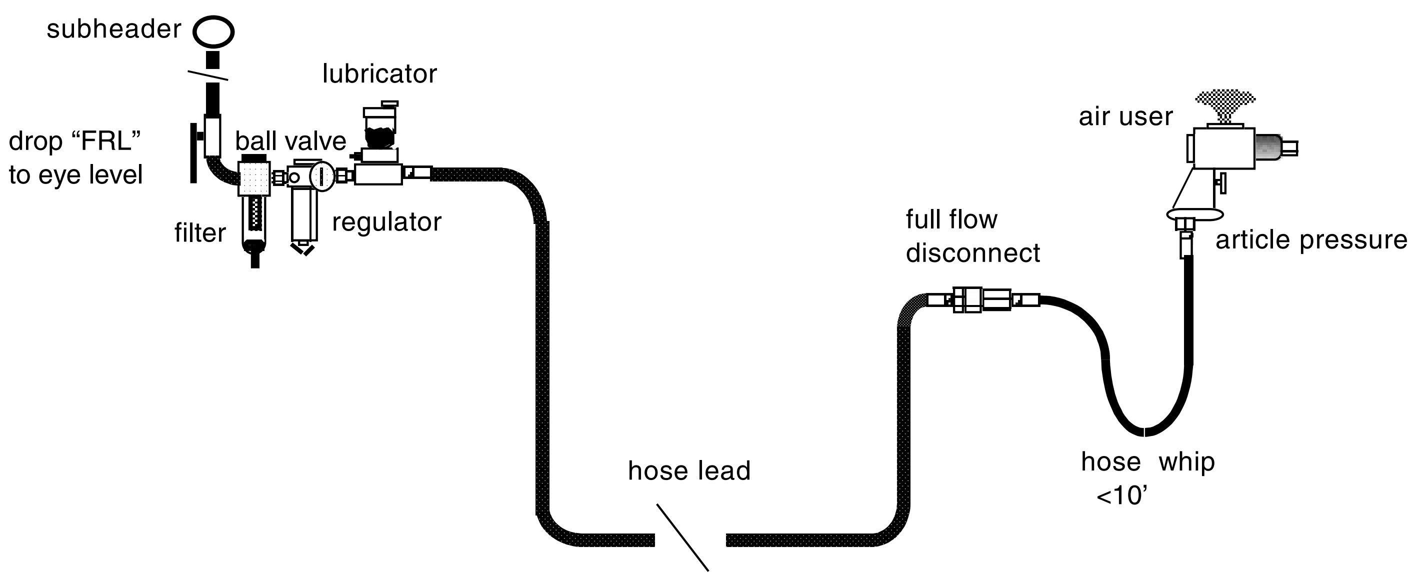
Most OEMs have a energy-inefficient philosophy regarding accessory components such as hose, fittings, sealant, disconnects, lubricators, regulators, shut off valves and filters.

diminish, the demand will artificially increase and the point-of-use pressure may even drop. Now you are looking for another compressor or compressors and jacking up the supply even higher. We call this "Less for More". Not your best investment strategy.

So how does this all start? It begins with the air-using OEM. It begins with how he selects components for the application, information from the air-using components OEMs and rules for the use of air that will not take operating cost or energy efficiency into consideration. Most OEMs have a energy-inefficient philosophy regarding accessory components such as hose, fittings, sealant, disconnects, lubricators, regulators, shut off valves and filters. Keep the size small, keep it simple to operate and, most of all, keep the price down. See if the following is true for your point-of-use components selection:

- **a.** V1 tubing with push lock fittings.
- **b.** Double-braided 125 psig hose with rubber core held on hose barb with water hose banding.
- **c.** Teflon tape for sealant.
- **d.** General line industrial disconnects generally compatible with Foster/Hanson style disconnect male and female fittings.
- **e.** Drip-feed lubricators which work on a Venturi principle. As you restrict the air across the lubricator, you increase the oil feed.
- **f.** Regulators, generally piston style.
- **g.** Filters — sintered bronze elements with a manual drain.
- **h.** Shut-off valves — mostly gate, globe or non-full port ball type.

Illustration #1



These components are specified either by the tool crib or purchasing. There are no differentials specified, such as differential pressure at highest rate of flow at the inlet, in the case of tube and hose include maximum length and lowest inlet pressure. In some cases, it is also necessary to specify highest inlet temperature. You can also select components based on C's of V charts for the component, although most OEMs don't have this data. Category A is generally expressed in terms of OD in fractions of an inch. On paper, Category A and B will produce the lowest pressure drop at the highest pressure (when one assumes that the flow remains constant regardless of the inlet psig). A, B, D, E, F, G and H, generally speaking, are all the same size, regardless of flow or psig requirement. Most of these components are selected based on either ¼" or ½" size. When these components are selected on these criteria, the article pressure varies as a function of the flow and resulting differential pressure, even when the inlet pressure is constant. This obviously affects the quality and integrity of the application.

I had the good fortune of direct reporting to Dr. E. Demming on a major automotive project in 1978. After our initial evaluation of the system, we met with engineering management for our first review. Dr. Demming described the operation of the system as "minus nothing/plus anything". By this, he meant that the focus of the utilities management was on maintaining minimum acceptable results for the system. They agreed. When we asked how high the pressure would perturbate to, no one knew. He described the results as poor quality results in manufacturing at the highest possible cost. The chief engineer asked what he felt the alternative should be. Dr. Demming described it as "plus nothing/minus something". In this scenario, as an example, the standard would be an article pressure of no more than 76 psig and a design differential of 5.2 psig at highest inlet flow and temperature and lowest inlet pressure at specified rate of flow plus <3 psid for dirt loading and the impact of leak attrition. The results are the lowest operating cost at the highest possible quality. This is the essence of Statistical Process Control. This was not the end of the lesson. The engineer didn't like Demming's analogies. Demming observed the engineers concern and said, "What's the problem?" Before the engineer could speak, Demming said, "I guess you have an assignment of responsibility problem. When you operate based on plus anything/minus nothing, no one is responsible for the quality results in manufacturing, nor the cost of services." The engineer obviously didn't like Demming's answer. His retort was, "OK, so let's say we agree to play your game...only at 81 psig instead of 76 psig maximum inlet pressure." Demming was profound at this point when he said, "I suppose we could live with that. I would rather be consistently wrong, rather than inconsistently right...at least we would know what the problem was." For me, this forever changed the way that I look at air systems. BP

In the ensuing articles, we will discuss such subjects as rate of flow, rate of change, measurement, sizing demand at the point-of-use equipment and flat lining high rate of flow and change applications using storage of potential energy to reduce the system's supply pressure, improve the energy used as well as control the quality of the application.

Mr. Foss has been auditing compressed air systems since 1969. He has written two books on the subject of compressed air systems, published more than 75 articles and conducted more than 650 one- to three-day seminars. He has audited more than 1,700 complete systems (generally medium to larger size) and cross-audited more than 2,500 added systems.

He can be contacted at Air's a Gas Inc, 3728 Berrenstain Drive, St. Augustine, FL, 32092. His phone numbers are: 904-940-6940 (office) and 904-826-7222 (cell). His email address is airsagas@aol.com.

THE TECHNOLOGY PROVIDER

Direct*AIR*®: Compressed Air as an Outsourced Utility

BY TIM TENSING, AIR TECHNOLOGIES

Introduction

Compressed air systems are a source of power (a utility) present in virtually all manufacturing and process industries. What is unique about this utility is that facilities own the utility and are responsible for all the installation, generation, transmission and maintenance costs of the compressed air system. Outsourcing compressed air as a utility, while not a new idea, is a growing trend in industry as service providers have increased their ability to meet customer expectations.

Owning an Older System and Faced with a Capital Expenditure

Recently, a Tier 1 automotive supplier was experiencing reliability problems with an older air compressor. Air Technologies was asked to visit the facility and make a proposal for a new variable speed air compressor. After separate meetings with the plant manager, operations manager, controller and general manager, it became apparent that the problems in this aged compressed air system went far beyond the replacement of just this one air compressor.

The operations manager said that recurring problems with their compressed air system had turned it into a significant cost center in the plant, stating, "Our annual expenditures related to our compressed air system include $120,000 in maintenance costs, $248,000 for electricity and $10,000 in annual rental costs." As the compressed air equipment had gotten old, this manager commented, "We are experiencing significant costs with the air compressor bearings and air ends going bad." For this reason, back-up rental air compressors were needed quite often.

The DirectAIR® Compressed Air Facility

In addition to the high operating costs of the system, it was disrupting production. The compressed air treatment (dryers and filters) equipment had problems and water was present in the compressed air distribution system. The plant manager commented, "We are incurring continuous maintenance problems. Excessive water in the air lines results in rust problems with the pneumatics on our production equipment (solenoids and cylinders)." He went on to state, "We are seeing expensive repair costs to our production equipment due to the air quality problem."

Air Technologies is a leading compressed air auditing firm, and our system assessment analysis showed that with a capital expenditure of $315,000, this facility could own a modern and efficient compressed air system capable of addressing all these issues. The customer stated, however, that accessing capital for this project would be an issue for them. That is when we proposed that they outsource their compressed air requirements as a utility and take advantage of the Direct*AIR*® compressed air utility alternative solution. The agreement was signed, and within two months, their new Direct*AIR*® system was installed and fully operational.

The Direct*AIR*® Compressed Air Utility Alternative Solution

Compressed air is used in nearly every facet of this manufacturer's production process, and is therefore a critically important utility. The customer's top three objectives for their compressed air system were to:

1. Meet production requirements 24 hours per day, 365 days per year
2. Guarantee required air pressure, air flow and air quality (dew point)
3. Reduce energy costs

Based upon the results of the system assessment, Air Technologies built dual customized Direct*AIR*® modules to meet the needs of this facility. A total of 3,710 cfm at 125 psig can be supplied by this system. More importantly, the system includes the latest technologies in heat recovery and compressor controls. This enables the customer to use the most modern technologies aimed at reducing energy costs — without having to come up with the capital. This particular system includes six 125 horsepower (6 x 125 hp) base load air compressors and one 125 hp variable speed drive air compressor to maximize the customer's energy efficiency. Compressed air quality is ensured with new compressed air dryers and filters installed in the module.

The Direct*AIR*® facility is delivered pre-manufactured to the greatest extent possible and ready to run in a custom-engineered modular facility. The module is installed just outside the plant's exterior wall. The facility is secured to prevent any tampering and is engineered to provide an ideal operating environment through all four seasons of the year — from hot, humid summer days to sub-freezing winter temperatures.

THE TECHNOLOGY PROVIDER

DirectAIR®: Compressed Air as an Outsourced Utility

The ManagAIR® Monitoring and Control System

ManagAIR® Monitoring and Control System

The Utility Services group at Air Technologies developed DirectAIR® fifteen years ago. Air Technologies' Compressed Air Utility Service has been providing "over-the-fence" compressed air to more industrial customers across the eastern half of the United States than anyone else in the country. There are currently 35 unmanned DirectAIR® compressed air generation sites that are owned, operated, monitored and maintained by Air Technologies to provide a 24/7 supply of reliable, clean, dry air. The installations range from 100–5,000 hp of air compressors. With more than 1.3 million hours of combined operation and without a single continuous hour of low air pressure, the DirectAIR® sites have proven the concept that outsourcing compressed air as a utility is a practical and profitable alternative.

A key step in the market acceptance of this alternative was Air Technologies' investment in the exclusive ManagAIR® control system and control center. The ManagAIR® control system monitors and controls the onboard equipment as well as compressed air pressure, flow and dew point. If any equipment or performance abnormalities occur, ManagAIR® automatically contacts the DirectAIR® Service and Operations Team for an immediate response. The system is accessed remotely within minutes of the notification, and our technicians, located in the control center, take the appropriate corrective action.

Outsourcing compressed air as a utility, while not a new idea, is a growing trend in industry as service providers have increased their ability to meet customer expectations.

Installation and Feedback

DirectAIR® includes the electrical, foundation, rigging, condensate drainage, and piping installation that enables the customer to spend their capital investment in other areas that help drive their top and bottom lines. And DirectAIR® is very flexible, with additional cfm capacity that can be added in very short order.

The start-up and transition experience is also designed to be seamless for the customer. This particular customer commented, "We had a very smooth transition, in fact it went much smoother than I expected. The transition was seamless and flawless, with no change in plant air pressure. There was never a time that I was in doubt about the cut over. At no time did we lose air pressure in the plant and we were at full production during the changeover."

With Air Technologies' help, customers will receive 100% reliable compressed air. Here are some of the comments from this customer after having the experience of their new DirectAIR® Solution:

"I have forgotten all about air compressors already!"

"Fabulous. I have no air or water concerns anymore."

*"Haven't thought about compressed air ever since we transitioned over to Direct*AIR®*."*

*"I would certainly recommend it based upon our experiences so far, and would be happy to entertain perspective Direct*AIR® *customers in the future with a site tour of our Direct*AIR® *facilities."*

THE TECHNOLOGY PROVIDER

Direct*AIR*®: Compressed Air as an Outsourced Utility

"We had a very smooth transition, in fact it went much smoother than I expected. The transition was seamless and flawless, with no change in plant air pressure. There was never a time that I was in doubt about the cut over. At no time did we lose air pressure in the plant and we were at full production during the changeover."

Costs and Payback

The costs for the Direct*AIR*® utility solution include a monthly fee to Air Technologies and the associated energy costs are retained by the customer. The Direct*AIR*® alternative, put simply, allowed this customer to treat compressed air as any other utility and pay for it as a monthly operating expense with the resulting tax benefits. No capital expenditures are required and there are no maintenance costs (and no surprises). There are also no emergency rental air compressor costs. Plant management and staff no longer need to spend any time working on or managing compressed air system issues.

A thorough financial analysis and Net Present Value (NPV) cash flow comparison made Direct*AIR*® a viable choice. The conservative cost estimates did not include the reduction of the current production costs being incurred, such as:

- Internal work hours dedicated to operating and maintaining their compressed air equipment
- The product scrap resulting from low air pressure or excessive water in the lines
- Costs to repair downstream production equipment due to on-going wet air

DirectAIR® facilities range from 100–5,000 hp

The monthly Direct*AIR*® fee was lower than the multiple costs outlined above. The net benefit to the customer over an eight-year projected comparison was over $300,000. Importantly, the new outsourced utility solution reduced energy costs by $58,000 per year (23.5%) and eliminated the capital requirement the customer was facing of $315,000 in compressed air equipment replacement costs. BP

For more information, contact Tim Tensing, DirectAIR® account manager, AIR Technologies at Tel: 513-315-0343 or email: ttensing@aircompressors.com, www.aircompressors.com.

A Kroger Company Bakery SAVES ENERGY

BY BETH TOMPKINS, JETAIR TECHNOLOGIES, LLC.

With compressed air utilized by 70% of U.S. manufacturers and representing 10% of all electricity usage (according to the Department of Energy), optimizing use and exploring innovative alternatives offers profit maximization opportunities.

Introduction

Beginning with founder Barney Kroger's decision to be the first United States grocer to incorporate bakery goods manufacturing, The Kroger Company has maintained a tradition of exploring alternative solutions to increase operational efficiency and performance and to reduce costs. Recently, The Kroger Company's Indianapolis bakery identified the use of compressed air in a blowoff and conveyor gap transfer as a major source of energy loss and cost waste. According to the U.S. Department of Energy, "inappropriate use" of compressed air, like blowoff, produces high-pressure atmosphere bleed, leading to significant energy loss and unnecessary operational costs. Carrying a 10–15% efficiency return (according to the Department of Energy), compressed air applications can often be achieved more effectively, efficiently and less expensively with alternative solutions using a high flow rate and moderate pressure. Looking for alternative solutions for their blowoff and gap transfer applications, The Kroger Company contacted JetAir Technologies. JetAir Technologies' resulting custom, high-speed centrifugal motor and blower system offered The Kroger Company a 93% true energy power and cost savings, with an impressive payback of only 2.7 months.

A KROGER COMPANY BAKERY SAVES ENERGY

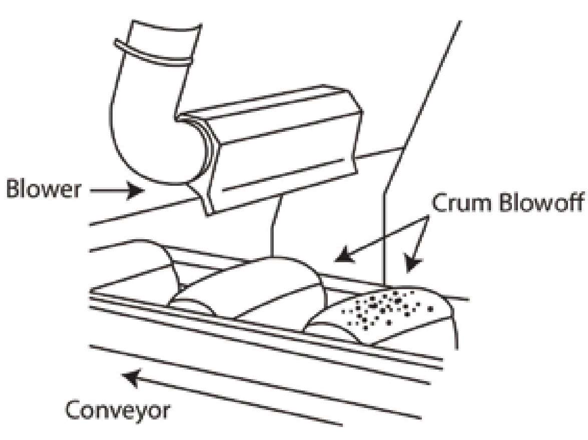
The Kroger Company's team was very impressed with the system's superior performance in both the blowoff and conveyor gap transfer application, and were interested in the possible cost and energy savings.

Problem

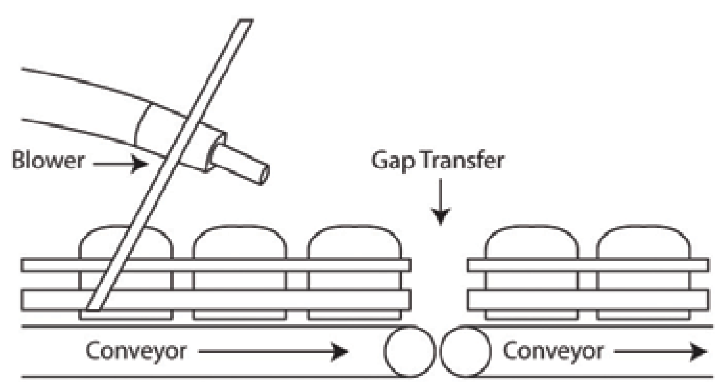
In an effort to optimize operational efficiency, The Kroger Company's Indianapolis bakery conducted an energy usage and cost audit of their bread manufacturing systems. The Kroger Company's evaluation identified the use of compressed air in both a pre-slicing application and a pre-packaging application as two sources of significant energy loss and operational cost. The Kroger Company was generating 90 psi of compressed air for a needed 1.75–2 psi at the application sites. At the first application site, the compressed air was directed through a single ¼" copper nozzle mounted above the conveyor. This application provided gap transfer assistance of the loaves from the baking conveyor to the slicing conveyor. At the second application site, the compressed air was directed through a ¼" copper pipe drilled with seven holes and mounted above and across the width of the conveyor. This second application provided loaf-top crumb blowoff between the loaf slicer and packaging system. Both applications were replicated on four manufacturing lines (a total of eight applications).

At each nozzle, the flow was measured at 70 cfm, bringing the flow measurement for the entire system to 560 cfm. Assuming a rate of 4.4 cfm per kW, the eight applications were requiring a total of 171 horsepower, or 127.3 kW of energy generation. With an operating schedule of 24 hours a day, five days a week, 52 weeks a year, the annual energy usage totaled 794,182 kWh. Assuming a rate of $0.07 kWh, the eight applications were costing The Kroger Company $63,376 annually in energy and maintenance costs.

At The Kroger Company's Indianapolis bakery, JetAir Technologies' applications engineers set up a high-speed, centrifugal blower and air knife test system to demonstrate its operational efficiency, energy savings and quality performance. The Kroger Company's team was very impressed with the system's superior performance in both the blowoff and conveyor gap transfer application, and were interested in the possible cost and energy savings.



Crumb Blowoff



Gap Transfer

Solution

Returning to the applications lab, the JetAir Technologies' engineering team designed a custom solution, driven by the JET-2™ high-speed motor and blower fitted with Variable Frequency Drive (VFD) technology and a user-friendly HIM — Powerflex 70/700 keypad. Replacing the copper tubing at the four blowoff applications, JetAir Technologies mounted MX™ air knives (via adjustable mounts) above the conveyor and connected by 3" (75mm) diameter flexible hoses. Replacing the copper nozzles at the four conveyor transfer points, JetAir Technologies mounted 2" diameter JetBlast air nozzles (via adjustable mounts) above the conveyor at the transfer point and connected by 2" (50mm) diameter flexible hoses.

Testing of the custom solution demonstrated significant energy and operational savings. The Kroger Company's original system consumed 171 hp (127.3 kW). JetAir Technologies' custom JET-2™ system, on the other hand, enabled a 93% reduction in true energy consumption, registering at 12 hp (9 kW) or a reduction of 159 hp. Based upon The Kroger Company's production cycle (24 hours/day, five days/week, 52 weeks/year) and 127.3 kW per hour rate, JetAir Technologies estimated the JET-2™ custom solution's energy cost as $4,362 annually (including maintenance). The Kroger Company's annual cost savings was an impressive $59,014 per year, or 93%! Thanks to these energy and cost savings, The Kroger Company recognized a 100% return on their investment in only 2.7 months.

> "We are very happy with the performance. This is clearly superior equipment."
>
> — Kroger Company
> Indianapolis Bakery Team

JET-2™ Motor and Blower

MX™ Air Knife

A KROGER COMPANY BAKERY SAVES ENERGY

The Kroger Company contacted JetAir Technologies. JetAir Technologies' resulting custom, high-speed centrifugal motor and blower system offered The Kroger Company a 93% true energy power and cost savings, with an impressive payback of only 2.7 months.

Results

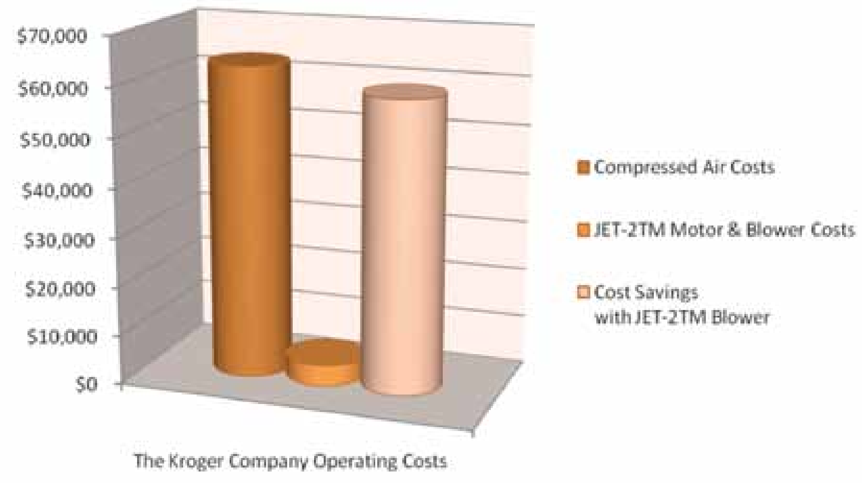
After installation, The Kroger Company was pleased regarding the system's effective performance, energy efficiency and the resulting return on investment.

"We are very happy with the performance. This is clearly superior equipment," said the Kroger Company Indianapolis bakery team.

Substituting a highly effective alternative solution like centrifugal blowers for the "inappropriate use of compressed air" (as defined by the DOE's Compressed Air Challenge®), The Kroger Company was able to reduce the amount of compressed air bleed to the atmosphere and increase their cost savings. By employing high-speed centrifugal blowers as an alternative solution for their blowoff and gap transfer, The Kroger Company was able to lower their monthly energy costs from $5,281/mo. to $364/mo. This energy and cost savings totaled a monthly energy savings of $4,917 — a 93% reduction of monthly cost.

Focusing on innovation as a method of operation and profit optimization, The Kroger Company has continued to dominate as one of the top grocery retailers. In this age of rising energy costs and environmental impact concerns, manufacturers would be wise to follow suit. With compressed air utilized by 70% of U.S. manufacturers and representing 10% of all electricity usage (according to the Department of Energy), optimizing use and exploring innovative alternatives offers profit maximization opportunities. Emerging, energy-efficient technology like high-speed centrifugal blowers offers an effective, environmentally conscious alternative to compressed air that translates to bottom-line energy and cost savings. BP

For more information, please contact Brendan Smith, JetAir Technologies LLC, Tel: 805-654-7000 Main, or email: brendan.smith@jetairtech.com, www.jetairtech.com.



Operating Cost Savings with JET-2™ Blower and MX™ Air Knife

OPTIMIZING PNEUMATIC SYSTEMS FOR EXTRA SAVINGS

BY RON MARSHALL FOR THE COMPRESSED AIR CHALLENGE®
EDITS BY DAVID BOOTH, JAN ZUERCHER, BILL SCALES

KNOW PRESSURE COMPRESSED AIR CHALLENGE®

Compressed air users looking for energy reduction often identify their air compressors as a prime area for savings potential. But what about end uses? As attendees of the CAC® **Fundamentals of Compressed Air Seminars** learn, there are a large number of obvious measures that can be implemented, such as leakage reduction, reducing open blowing and eliminating inappropriate uses. However, there are other more technical opportunities available that involve properly specifying or redesigning existing pneumatic circuitry in compressed air-operated machines and processes.

"In the past, energy was relatively cheap, thus only the initial project cost received much consideration in machine design," says Jeff Yarnall, a technical service provider for BPA and a CAC® advanced level instructor. "If pneumatics could perform a task, automation machinery was designed around using compressed air rather than hydraulics, direct electro-mechanical action or even hiring a person to do the job. As labor became more expensive, automation and machinery has taken the place of boring, repetitive and sometimes dangerous work.

Fast forward to the present … energy costs now represent approximately 75% of the total cost of running a compressed air system. For the past 12 years, the CAC® has been training plant engineers, maintenance managers, operators and plant managers that energy costs should now be the driving force behind compressed air decisions. Most have embraced these concepts and have upgraded their supply-side to reduce costs. We are now entering the next phase of cost reduction — use compressed air appropriately or switch to another more efficient source of energy. Because of rising energy costs, the time is right to look into demand-side savings."

BC Hydro, a Compressed Air Challenge® sponsor, has recognized this potential for years as part of their **Compressed Air Initiative**, and encourages customers to reexamine the way their compressed air powered actuators use energy. The following is an adaptation of a BC Hydro publication called *Saving Energy through Compressed Air Systems*:

Compressed air is widely used in industry today. Although it may be performing adequately, it's well worth taking a closer look at the system to improve operating efficiency, since potential savings could add up to thousands of dollars in operating costs and result in significantly reduced greenhouse gas emissions every year.

A key question that should be considered is: "In a particular application, does compressed air have operational and process advantages that would warrant the use of compressed air over other methods of lower-cost electrical energy conversion?"

Fundamentals of Compressed Air Systems WE

The Compressed Air Challenge® (CAC®) is pleased to announce that the Winter 2010 session of **Fundamentals of Compressed Air Systems WE** (web-edition) is coming soon. Led by our experienced instructors, this web-based version of the popular Fundamentals of Compressed Air Systems training uses an interactive format that enables the instructor to diagram examples, give pop quizzes and answer students' questions in real time. Participation is limited to 25 students. Please visit **www.compressedairchallenge.org** to access online registration and for more information about the training.

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

Alternative Power Systems

The three most commonly used power conversion systems in industry are electro-mechanical, hydraulic and compressed air. Each has good applications, but compressed air always uses the most energy. Figure 1 illustrates an object required to be pushed off a roll case with a force of 2,830 pounds at a speed of 1.5 feet per second. The theoretical horsepower to perform this work is 7.72 hp with no efficiency loss.

$$\text{Actual horsepower} = \frac{\text{Theoretical hp}}{\text{System efficiency}}$$

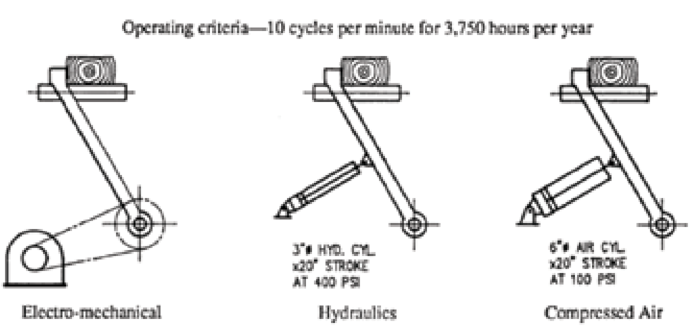


Figure 1 – Three methods to accomplish the same operation

TABLE 1 – ALTERNATIVE POWER SYSTEMS (SOURCE: BC HYDRO)				
DRIVE	**% EFFICIENCY**	**HP**	**KWH PER YEAR**	**$ PER YEAR**
Electro-mechanical	90	8.6	4,455	$446
Hydraulics	70	11.1	5,750	$575
Compressed Air	23	34.5	17,973	$1,797
Note: Based on "push" portion of the cycle only.				

Energy Loss Sources and Areas for Saving

Excessive Pressures — Pressure Reduction

The system operating pressure varies from one industry to another. In the sawmilling industry, a large number of compressors typically run at 105–115 psig. On the other hand, pulp mills often run their compressors at 90 psig. Some secondary manufacturing industries run as low as 70–80 psig. The system pressure should not be any higher than is functionally necessary, since the greater the pressure, the higher the energy cost to produce the increased pressure. As the pressure increases, a factor called the compression ratio (CR) increases, as demonstrated in the following formula:

$$\text{The Compression Ration (CR)} = \frac{\text{System Pressure (psig)} + \text{Atmospheric pressure (psia)}}{\text{Atmospheric pressure (psia)}}$$

$$\text{For example, at sea level, 100 psig system pressure CR} = \frac{100 + 14.7}{14.7} = 7.8$$

A rule of thumb used for single-stage positive displacement rotary screw compressors is that for every 1 psi change in compressor outlet pressure, there is a corresponding 0.5% change in energy requirements to produce the compressed air.

Once the system pressure is established, further reductions in pressure can be made at individual actuators where full system pressure is not required. For example, consider an application as shown in Figure 2 where a work piece is being swept off a roll case. For the following

OPTIMIZING PNEUMATIC SYSTEMS FOR EXTRA SAVINGS

CAC Qualified Instructor Profile

Roger Antonioli
Scales Air Compressor Corp.
1500 Tribbitt Avenue
Sharon Hill, PA 19079
Phone: (610) 522-8480
Fax: (610) 522-8481
rantonioli@scalesair.com

JRoger Antonioli currently serves as senior account manager and compressed air systems engineer for Scales Air Compressor Corporation at its Sharon Hill, PA facility. Roger has over 30 years of experience in the field of compressed air sales and marketing, and during these years, he has held such positions as field sales engineer, sales manager and vice president of sales and marketing for compressed air distributors.

With a masters degree in education and a B.A. in English, Roger spent 12 years prior to his compressed air career as a professional English and reading teacher at the high school level. Over the years, Roger has been able to couple his educational background and teaching skills with his knowledge of compressed air systems for the purpose of instructing his clientele on the proper utilization of compressed air, and the inherent energy dollar savings they will accrue by implementing a well thought out and engineered air system.

formula, assume that the pressure required to perform the work is 60 psi, and use the data contained in Table 2.

scfm = cylinder volume x cycle x compression ratio

Where:
Cylinder volume = 1.14 cubic feet
Cycle = 10 times per minute
Compression Ratio = $\frac{60 \text{ psig} + 14.7 \text{ psia}}{14.7 \text{ psia}} = 5.08$
scfm = 1.14 x 10 x 5.08 = 58 (for the power stroke only)

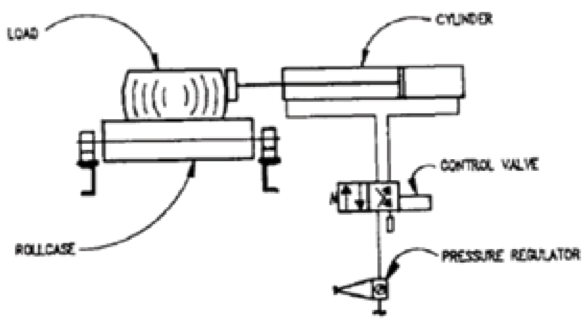


Figure 2 – Kicker Example (Source: BC Hydro)

TABLE 2 –COMPARING OPERATION AT DIFFERENT CYLINDER PRESSURES (SOURCE: BC HYDRO)						
PSI BASE @	AIR SCFM	EQUIV. HP	KW	ANNUAL ENERGY USE (KWH)	LOST KWH PER YEAR	LOST $ PER YEAR
60 psi	58.0	14.5	10.8	40,564	0	$0
70 psi	65.8	16.5	12.3	46,019	5,455	$546
80 psi	73.5	18.4	13.7	51,404	10,840	$1,084
90 psi	81.3	20.3	15.2	56,859	16,295	$1,630
100 psi	89.1	22.3	16.6	62,314	21,750	$2,175

Assumed operation: two 7.5-hour shifts per day, 250 days per year at $0.10 per kWh.

Dual Pressurization of Air Cylinders

Another option for power savings without any production losses is that of dual pressurization. Dual pressurization becomes a valid means of energy savings when an air cylinder/actuator needs full pressure in one direction only, and can return with minimal pressure. In this concept, high-pressure plant air (or air regulated to required pressure) is put into the extension end of the cylinder to move the heavy load, and on the return stroke a lower pressure is used. Table 3 on the following page shows the magnitude of energy losses in over-pressuring the return stroke of a cylinder.

TABLE 3- DUAL PRESSURIZATION — COMPARISON OF COSTS (SOURCE: BC HYDRO)										
	PRESSURE		AIR CONSUMPTION						INCREMENTAL LOSS	
CASE (BASE)	EXTEND P1	RETRACT P2	EXTEND SCFM	RETRACT SCFM	TOTAL SCFM	EQUIV HP	EQUIV KW	KWH/ YEAR	KWH/ YEAR	$/ YEAR
1	90	30	42	16.8	58.8	14.7	11.0	41,123	0	0
2	90	50	42	24.3	66.3	16.6	12.4	46,369	5,246	$525
3	90	70	42	31.8	73.8	18.5	13.8	51,614	10,491	$1049
4	90	90	42	39.3	81.3	20.3	15.2	56,859	15,736	$1,573

Utilization of Single-Acting Cylinders

Another energy-saving option is to consider single acting cylinders with gravity or spring return in places where high-pressure air is required only in one direction. On the return stroke, either gravity or a spring may be used to return the cylinder to its original position. This would result in significant energy savings as shown in Table 4.

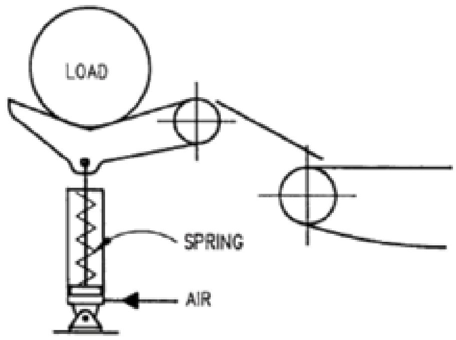


Figure 3 – Example of Spring Return (Source: BC Hydro)

TABLE 4: SINGLE ACTING CYLINDER VS. DOUBLE ACTING (SOURCE: BC HYDRO)						
CASE	AIR SCFM	EQUIV. HP	KW	ANNUAL ENERGY USE (KWH)	LOST KWH PER YEAR	LOST $ PER YEAR
Spring Return	42.0	10.5	7.8	29,374	0	$0
Pressure Both	81.3	20.3	15.2	56,859	27,485	$2,749

Designing to Minimize Pressure Drop

Excess pressure drop in a system can add up to hundreds of dollars in energy loss each year. Whenever a fluid flows through an object, there are losses: the more air you try to push through, the more resistance there is to flow. The more resistance, the more force or pressure is required to move the air. The pressure used to overcome this resistance is referred to as pressure drop. Energy savings can be achieved with proper design and selection of air components and distribution piping.

Say, for example, the pressure drop for a 500 hp compressed air system is reduced 2 psi. Energy cost savings could be: 500 hp x .746 kW per hp x 6,000 hours per year x 1.0% x $0.10 per kWh = $2,238 per year.

Directional Control Valves

Directional control valves are used to start, stop or change direction of flow in compressed air applications. A wide variety of these valves are used by industry. Control valves are designed for different applications. Once a suitable type is selected, then the flow capacity of the valve must be matched to the application. The flow capacities of directional control valves are rated by a flow coefficient (Cv). As the Cv increases, the pressure drop decreases, while maintaining the same flow and final pressure parameters. Therefore, careful consideration should be given to Cv values when selecting valves. See the CAC® *Best Practice for Compressed Air Systems* book for more information.

Filter Regulator Lubricators (FRLs)

FRLs are secondary air preparation components located just before the actuator, and are sometimes referred to as the air station. This part of an air system must not be taken for granted or ignored, because it must do the required function properly and it must do it as efficiently as possible. The proper design and selection of the secondary preparation system is essential to minimize the efficiency loss/pressure drop through it. If pressure drop is ignored, an FRL station can have a pressure drop in excess of 10 psi, which translates to an extra energy requirement of 5%. A recommended pressure drop to work towards is 2 psi.

Distribution Piping

A poorly designed compressed air distribution system produces low pressure at the actuators, insufficient compressor capacity and lack of air flow. The more pressure drop there is in a distribution system, the higher the compressor pressure setting must be in order to provide the required pressure at the end use. The higher the pressure at which the compressor must operate, the higher the power required to generate the compressed air.

OPTIMIZING PNEUMATIC SYSTEMS FOR EXTRA SAVINGS

CAC Qualified Instructor Profile

Jeff Yarnall, PE
Rogers Machinery Co. Inc.
14650 SW 72nd Avenue
Portland, Oregon 97224
Phone: 503.639.0808
Fax: 503.603.1994
Cell: 503.706.1637
Email: jeff.yarnall@rogers-machinery.com

Jeff Yarnall has 32 years experience with compressed air and process vacuum systems, including: system design, applications, installation, troubleshooting, maintenance, controls and energy audits. Responsibilities include major capital project management, both in the United States and abroad, from engineering, sales, procurement and documentation. Jeff also serves as a consultant to clients for energy audits and assessments, educational instruction and system design.

Over 1,500 people have attended Jeff's classes on compressor maintenance, system optimization and the Compressed Air Challenge® with excellent reviews. In addition to classroom theory, Jeff uses the experience of over 800 audits to illustrate the practical side of compressed air systems operations.

Leaks

Experienced compressed air auditors find that most of the leaks and pressure losses in a system are in the final end uses (valves, fittings, hoses, etc). These waste energy, but can also negatively affect the performance of the pneumatic process through lower power stroke, slower operation speed and inconsistent operation. Monitoring of important processes can reveal when problems are occurring. A baseline for the air requirement, flow, pressure and even temperature can be established when the system is relatively free from leaks, when no unnecessary air is being used and when production is at normal levels. With this baseline, the air system can be monitored over a set period of time under normal conditions, and a control chart or history can be developed. This provides a picture of what normal operating conditions look like and can trigger action when required.

"Many times, compressed air users focus their attention on the air compressor as the problem when the air pressure they require isn't adequate for their demand-side process equipment needs," explains Roger Antonioli, senior account manager for Scales Air Compressor Corporation and a CAC® Fundamentals instructor. "However, too often the problem lies instead in their air distribution piping system. Some common issues revolve around systems that were inadequately sized or designed initially, or ones which were sized initially for an earlier air flow requirement that has now since grown to a different profile of air usage demand. There are also many piping systems which have been allowed to deteriorate without proper attention and repair, and those that were designed with little thought of appropriate storage requirements to accommodate demand-side process operations. Compressed air system owners and operators need to realize that poorly designed air distribution systems may cost less initially to purchase and install, but the life cycle costs of poorly designed air distribution systems will far exceed their initial purchase and installation cost savings."

A further discussion of pneumatic system optimization appears in the CAC® "*Best Practices for Compressed Air Systems*" Appendix 4 (this 325-page manual is available at the CAC® **bookstore**). To purchase your copy, go to our **Compressed Air Challenge®** website. BP

Visit www.compressedairchallenge.org for more information.

RESOURCES FOR ENERGY ENGINEERS

TRAINING CALENDAR

TITLE	SPONSOR(S)	LOCATION	DATE	INFORMATION
Compressed Air Challenge® Advanced Mgmt of Compressed Air Systems	Pacific Gas & Electric Company with US DOE's Industrial Technologies Program	San Francisco, CA	10/14/10–10/15/10	Cheryl Boswell-Barnes email: cjb9@pge.com www.compressedairchallenge.org
Compressed Air Challenge® Fundamentals of Compressed Air Systems	Manitoba Hydro Compressed Air Challenge®	Winnipeg, MB	10/26/10	Veronica Walls Tel: 204-360-7229 email: vwalls@hydro.mb.ca www.compressedairchallenge.org
Compressed Air Challenge® Advanced Mgmt of Compressed Air Systems	Manitoba Hydro Compressed Air Challenge®	Winnipeg, MB	10/27/10–10/28/10	Veronica Walls Tel: 204-360-7229 email: vwalls@hydro.mb.ca www.compressedairchallenge.org
Compressed Air Challenge® Advanced Mgmt of Compressed Air Systems	Atlas Copco ComEd-Energy Efficiency	Oak Brook, IL	11/8/10–11/9/10	Giuliana Losurdo Tel: 847-981-2627 email: giuliana.losurdo@us.atlascopco.com
Compressed Air Challenge® Fundamentals of Compressed Air Systems	KPPC, U.S. DOE, Kentucky Department for Energy Development and Independence	Louisville, KY	11/11/10	email: training@kppc.org Tel: 502-852-0965 www.kppc.org
Compressed Air Challenge® Fundamentals of Compressed Air Systems	Purdue University Indiana University	Fort Wayne, IN	11/17/10	Tel: 317-275-6822 Monica Cannaley email: mcannale@purdue.edu

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

COMPANIES

Ekomak Expands into Larger Facility

Ekomak Compressors opened a second factory in Erdine, Turkey. Ekomak Compressor distributors from 58 countries and four continents attended the opening ceremony, inaugurating the new 10,000 square meter plant. The plant represented the company's total investment of $6.5 million. Rolf Tappen, general manager of Ekomak Germany, commented, "The fact that this investment continued on schedule during the global financial crisis is a testimony to the growth and success of Ekomak compressors internationally." Mr. Tappen further commented that the new facility was built to produce 8,000 rotary screw air compressors per year. Ekomak is headquartered in Istanbul, Turkey and operates six subsidiaries in Asia, Europe and the Far East.

Ekomak Compressors
Rolf Tappen
Email: rtappen@ekomak.com.tr
www.ekomak.eu

RESOURCES FOR ENERGY ENGINEERS

PRODUCTS

Recycled Oil Heats Buildings

Employees at the 25 Five Rivers MetroParks facilities in the greater Dayton, Ohio area feel like they've struck gold — black gold. They've recently started collecting used motor oil from service vehicles that maintain the system's nearly 15,000 acres. They're recycling the used oil to generate heat for their offices and workshop. The environmentally friendly effort has spurred neighboring businesses and residents to contribute their used oil to the earth-friendly action.

Dave Spitler, assistant park manager, says he was searching for a better way other than using wood-burning stoves to heat buildings. "There was a big cost factor in man hours to have staff members cut and split wood for the stoves," says Spitler. "The Clean Burn furnace that we've installed is an economical and ecological solution for Five Rivers MetroParks."

Used oil storage tanks now collect hundreds of gallons of recycled motor oil from the park's 99 fleet vehicles and 98 small motorized vehicles (including Gators and lawn mowers), as well as through community contributions. After being refined, the oil is pushed through a filter and pre-heated. Then, the oil is injected into the Clean Burn furnace and burned at 1,800 ˚F. The high temperatures create low emissions (less than 1% allowable by EPA standards) and generate enough heat to warm the park's 2,400-square-foot facility.

Prior to obtaining the Clean Burn system, the park hired contractors to haul away and dispose of used oil. That costly process had the potential for environmental damage through spills and used more fossil fuels for transporting the waste oil. The furnace saves labor hours from the cutting of timber and provides an environmental, on-site system for recycling used motor oil.

"I've sent oil recycle barrels to all MetroParks facilities to collect their used oil," says Spitler. "Each park saves money since they no longer have to pay anyone to properly dispose of the oil. We bring the full barrels to the central furnace area and replace them with empty barrels. This is a sensible solution that would be viable for other parks nationwide to adapt in order to save money and close the loop on recycling efforts."

There are 80,000 Clean Burn functional furnaces and boilers located throughout the world that burn millions of gallons of used oil each year, onsite at the point of generation. This volume of used oil would otherwise be transported on highway systems and pose a considerable risk to spills and/or contamination to the environment.

Clean Burn
Tel: 1-800-331-0183
www.cleanburn.com

GHG Measurement

Process and plant engineers in a wide range of industries who are concerned about the U.S. EPA's greenhouse gas (GHG) monitoring requirements will find the ST51 Mass Flow Meter from Fluid Components International (FCI) provides the high performance and features required of these applications in an instrument that is easy-to-install, safe and requires virtually no maintenance to deliver a best cost solution.

The ST51 Flow Meter is ideal for the measurement and monitoring of industrial plant greenhouse gases. The ST51 features a no moving parts design that's non-clogging and operates over a wide flow range with low-flow sensitivity. Its packaged in an explosion-proof transmitter, and the calibration is matched to the user's actual gas composition and installation conditions.

For years, industrial process and manufacturing plants have been required by the EPA, state and local authorities to monitor flue or stack emissions with flow meters in the fight against air pollution. Flue gases are the general name given to the mixed composition hydrocarbon greenhouse gases that are the by-product of an industrial plant combustion process. A flue is typically a large pipe, duct, stack, chimney or other venting attached to a process or industrial manufacturing plant system such as a boiler, furnace, steam generator, oven, etc., through which waste gases are exhausted from the combustion process.

Flue gases are produced by many industries, including chemical and food processing, petroleum refining, pharmaceutical production, metals and advanced materials, paper plants, electric power generation plants and others. Depending on the type of plant, processes, fuel used and efficiency, flue gases include: nitrogen, carbon dioxide, oxygen and water vapor, sulfur oxides, nitrogen oxide, carbon monoxide, particulates, ozone and methane. These gases in our atmosphere absorb and emit radiation within the thermal infrared range, which has been identified as the primary cause of global warming.

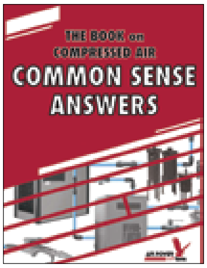
FCI designed the ST51 Flow Meter to measure and monitor GHG per the EPA's requirements. It features a thermal mass, insertion-style flow element with flow accuracy to ±1% of reading over a broad flow range from 0.3–400 SFPS (0.08–122 MPS), and repeatability of ±0.5% of reading. The flow element is available for use in line sizes from 2–24" (51–610mm). It operates over a wide turndown range of 100:1 and at temperatures from 0–250 °F (-18–121 °C). It withstands pressures up to 500 psig [34 bar (g)].

Fluid Components International is a global company committed to meeting the needs of its customers through innovative solutions to the most challenging requirements for sensing, measuring and controlling flow and level of air, gases and liquids.

Fluid Components International
www.fluidcomponents.com
Email: fcimarcom@fluidcomponents.com
Tel: 800-854-1993

LITERATURE & SERVICES PICKS

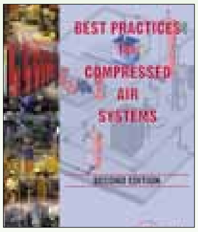
The Book on Compressed Air Common Sense Answers



NEW! Providing practical solutions to the everyday issues facing plant staffs who operate and maintain plant air systems and the engineering staffs who design and evaluate 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, is explained. 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).

Black/white print copy $85.00 U.S.
Color print copy $105.00 U.S.
To purchase, call Air Power USA at 740-862-4112
or visit www.airpowerusainc.com

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



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

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

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

Compressed Air Challenge®
www.compressedairchallenge.org

WALL STREET WATCH

BY COMPRESSED AIR BEST PRACTICES®

The intent of this column is to provide industry watchers with publicly held information, on publicly held companies, involved with the sub-industry of compressed air. It is not the intent of the column to provide any opinions or recommendations related to stock valuations. All information gathered in this column was during the trading day of September 20, 2010.

SEPTEMBER 20, 2010 PRICE PERFORMANCE	SYMBOL	OPEN PRICE	1 MONTH	6 MONTHS	12 MONTHS	DIVIDEND (ANNUAL YIELD)
Parker-Hannifin	PH	$68.53	$64.75	$64.53	$55.30	1.58%
Ingersoll Rand	IR	$34.89	$35.92	$34.53	$32.41	0.80%
Gardner Denver	GDI	$53.45	$50.12	$44.73	$35.17	0.37%
Atlas Copco ADR	ATLCY	$16.11	$14.35	$13.87	$11.97	2.42%
United Technologies	UTX	$69.53	$69.62	$72.66	$62.72	2.44%
Donaldson	DCI	$45.03	$43.91	$45.03	$36.23	1.11%
SPX Corp	SPW	$61.57	$59.83	$60.08	$63.63	1.62%

Parker Hannifin Reports Fiscal Fourth Quarter Earnings

Parker Hannifin Corporation (NYSE: PH) reported results for the fiscal 2010 fourth quarter and year ending June 30, 2010. Fiscal 2010 fourth quarter sales were $2.8 billion, an increase of 26% from $2.2 billion in the same quarter a year ago. Net income for the fourth quarter was $222.2 million, compared with $49.5 million in the fourth quarter of fiscal 2009. Earnings per diluted share for the quarter were $1.35, compared with $0.31 in last year's fourth quarter. Cash flow from operations in the quarter was $377.4 million, or 13.5% of sales, compared with $413.1 million, or 18.7% of sales in the fourth quarter of fiscal 2009.

"Order levels continued to increase this quarter and showed broad-based improvements across segments and regions, both sequentially and year over year," said chairman, CEO and president Don Washkewicz. "These contributed to the 27% increase in organic sales for the quarter, while foreign currency translation negatively impacted sales by 1%. Our total segment operating margin performance was particularly strong at 13.9%. Additionally, our Industrial North America segment margins reached 15.7%, reflecting ongoing success in executing our Win Strategy."

Fiscal 2010 sales were $10.0 billion, a decline of 3.1% from $10.3 billion in the previous year. Fiscal 2010 net income increased 9% to $554.1 million from $508.5 million in fiscal 2009. Earnings per diluted share increased 8.6% to $3.40, compared with $3.13 in the previous year. Cash flow from operations for fiscal 2010 increased to $1.2 billion, or 12.2% of sales, compared with $1.1 billion, or 11% of sales in the prior year.

Reflecting on the year, Washkewicz added, "In fiscal year 2010, Parker employees responded decisively to the conditions in our global markets. Our actions allowed us to deliver on what we committed to our shareholders, which was to produce much improved performance late in the year as order levels improved. Throughout fiscal year 2010, economic circumstances focused our priorities on managing our business for cash, while maintaining balance sheet strength and targeting 10% total segment operating margins. We were successful across all of these measures. Fiscal 2010 highlighted how our Win Strategy allowed us to withstand the worst economic downturn in 60 years and still deliver much higher operating margin levels than at the lowest point in past recessions. Despite being slightly down on revenues, we generated increased operating margins, increased diluted earnings per share and increased cash flow from operations."

Segment Results

In the Industrial North America segment, fourth quarter sales increased 33.1% to $1.0 billion, and operating income was $162.9 million, compared with $53.7 million in the same period a year ago. For the full year, Industrial North America sales declined 3% to $3.6 billion, and operating income increased 23.3% to $487.1 million, compared with fiscal 2009.

In the Industrial International segment, fourth quarter sales increased 30.4% to $1.0 billion, and operating income was $140.3 million, compared with a loss of $5.7 million in the same period a year ago. For the full year, Industrial International sales declined 2.2% to $3.8 billion, and operating income increased 12.4% to $394.1 million, compared with fiscal 2009.

In the Aerospace segment, fourth quarter sales increased 5.9% to $477.6 million, and operating income increased 9.5% to $64.1 million, compared with the same period a year ago. For the full year, Aerospace sales declined 7.4% to $1.7 billion, and operating income declined 20.6% to $208.0 million, compared with fiscal 2009.

In the Climate & Industrial Controls segment, fourth quarter sales increased 27% to $240.3 million, and segment operating income was $20.5 million compared with an operating profit of $0.9 million in the same period a year ago. For the full year, Climate & Industrial Controls sales increased 2.4% to $814.0 million, and the segment reported an operating profit of $53.5 million, compared with an operating loss of $3.7 million in fiscal 2009.

Orders

Parker reported an increase of 35% in total orders for the quarter ending June 30, 2010, compared with the same quarter a year ago. The company reported the following orders by operating segment:

- Orders increased 46% in the Industrial North America segment, compared with the same quarter a year ago.
- Orders increased 46% in the Industrial International segment, compared with the same quarter a year ago.
- Orders declined 3% in the Aerospace segment on a rolling 12-month average basis.
- Orders increased 35% in the Climate and Industrial Controls segment, compared with the same quarter a year ago.

Outlook

For fiscal 2011, the company has issued guidance for earnings from continuing operations in the range of $3.60–$4.40 per diluted share.

Washkewicz added, "We are in a very strong position for the year ahead. Parker has clearly demonstrated its ability to generate strong incremental returns on increased revenues. Our focus will continue to be on executing the Win Strategy, and given our financial flexibility, we anticipate ongoing investments in research and development, international expansion, acquisitions and distribution to grow our business."

www.parker.com

WALL STREET WATCH

Donaldson Reports Fiscal Fourth Quarter Earnings

Donaldson Company, Inc. (NYSE: DCI) announced its financial results for its fiscal 2010 fourth quarter.

"I am very pleased with our fourth quarter operating performance which delivered another EPS record. While we have seen a gradual improvement in global economic conditions, what has really driven our performance has been our relentless focus on those things we can control. We have focused on our Continuous Improvement initiatives, new product introductions, emerging market growth and the expansion of distribution for our Customers," said Bill Cook, chairman, president and CEO.

"Our sales grew 4% sequentially from the previous quarter and were up 22% from the prior year. Our sales growth, combined with our record operating margin of 14.5%, generated a 115% increase in operating income and a 117% increase in EPS. We have seen consistent improvement in our sales over the past 12 months, as each quarter's sales have been higher than the previous quarter.

"Sales in our Engine Products' segment increased 35% during the quarter over the prior year as equipment build rates improved at our OEM Customers, and our Aftermarket Products' sales remained robust due to better equipment utilization and recent market share 'wins.' Within our Industrial Products' segment, sales increased 7%, driven primarily by our Special Applications Products and stronger than expected dust collection sales in Industrial Filtration Solutions.

"Our overall sales improvement was truly global as local currency sales increased 28% in the Americas, 25% in Europe, 18% in Asia and 8% in South Africa.

"We continued to benefit from our ongoing product and process Continuous Improvement initiatives and better fixed cost absorption due to the higher volumes. For the full year, our operating margin was also a record 12.7%, helping to deliver our full year EPS of $2.10.

"We expect many of the trends that positively impacted our results in the second half of FY10 to continue benefitting us as we now start our new fiscal year."

Financial Statement Discussion

Gross margin was 36.3% for the quarter and 35.1% for the year, compared to prior year margins of 32.8% and 31.6%, respectively. The increase in our gross margin was the result of improved fixed cost absorption and ongoing Continuous Improvement initiatives. The prior year quarter gross margin included restructuring charges of $3.2 million. For the year, we incurred $7.5 million in restructuring and asset impairment charges in gross margin versus $10.1 million last year.

Operating expenses for the quarter were $112.4 million, up 8.6% from $103.4 million last year. As a percent of sales, operating expenses decreased to 21.8% from 24.6% last year. The prior year quarter included $3.5 million in restructuring charges. For the year, operating expenses were $420.5 million, up 0.2% from $419.8 million in the prior year. For the current year, we incurred $2.7 million in restructuring charges in operating expenses versus $7.7 million in the prior year.

As part of our ongoing share repurchase program, we repurchased 1,013,000 shares for $42.9 million during the quarter. For the year, we repurchased 1,652,000 shares, or 2.1% of outstanding shares, for $66.7 million.

FY11 Outlook

We expect a continued recovery in many of our end markets in FY11, with higher growth in the emerging economies. We forecast our full year FY11 EPS to be between $2.28 and $2.48.

- We are planning our total FY11 sales to be approximately $2 billion. For the full year FY11 versus FY10, higher local currency sales should be partially offset by foreign currency translation based on our planned rates for the Euro of USD1.27 and 87 Yen to the USD.
- In our gross margin, we forecast an increase in our purchased raw material costs and a less favorable sales mix compared to FY10. We also plan to make several key investments, which will increase operating expenses, to support our strategic growth plans. Consequently, we expect our full year operating margin to be 12.5–13.5%.
- Our full year FY11 tax rate is projected to be between 27–30%.
- We expect our full year free cash flow to be between $160 and $180 million, with capital expenditures projected to be between $70 and $80 million.

Engine Products: We expect full year sales to increase 6– 11%, including the impact of foreign currency translation.

- We anticipate sales to our construction and mining equipment OEM Customers will continue to improve as their production rates increase. We also project a modest improvement in the farm equipment market.

- We are forecasting slightly lower sales for our Aerospace and Defense Products due to the continued slowdown in U.S. military activity in Iraq and decreases in U.S. government spending for major programs.
- In our OEM On-Road Products' business, we believe that build rates for heavy- and medium-duty trucks will continue improving.
- Our Aftermarket Products' sales are expected to continue to grow as utilization rates for both heavy trucks and off-road equipment increase. We also expect to continue benefitting from the increasing amount of equipment in the field with PowerCore® and our other proprietary filtration systems.

Industrial Products: We forecast full year sales to increase 3–8%, including the impact of foreign currency translation.

- Our Industrial Filtration Solution's sales are projected to increase 3–8% as the demand for new filtration equipment is expected to improve as capital spending increases.
- We expect our Gas Turbine Products' sales to be stable, as the large power generation market appears to be bottoming out. Our longer-term outlook remains very positive with the eventual recovery of the global economy.
- Special Applications Products' sales are projected to increase 6–11%, as the end markets for both our disk drive filters and membrane products are expected to grow. BP

COMPRESSED AIR BEST PRACTICES®
www.airbestpractices.com

ADVERTISER INDEX

COMPRESSED AIR BEST PRACTICES®
www.airbestpractices.com

Advertising & Editorial: Rod Smith
rod@airbestpractices.com
Tel: 412-980-9901

Subscriptions & Administration: Patricia Smith
patricia@airbestpractices.com
Tel: 412-980-9902

A Publication of: Smith Onandia Communications LLC
217 Deer Meadow Drive
Pittsburgh, PA 15241

Compressed Air Best Practices® is published monthly by Smith Onandia Communications LLC., 217 Deer Meadow Drive, Pittsburgh, PA 15241. Phone 412-980-9902, email patricia@airbestpractices.com. Compressed Air Best Practices® is a trademark of Smith Onandia Communications, LLC. Publisher cannot be held liable for non-delivery due to circumstances beyond its control. No refunds. Standard postage is paid at 233 Jefferson Street, Greenfield, Ohio 45123. Canadian and international distribution: IMEX International Mail Express, 1842 Brummel Drive, Elk Grove Village, IL 60007. POSTMASTER: Send address changes to Compressed Air Best Practices,® 217 Deer Meadow Drive, Pittsburgh, PA 15241. SUBSCRIPTIONS: Qualified reader subscriptions are accepted from compressed air professionals, plant managers, plant engineers, service and maintenance managers, operations managers, auditors, and energy engineers in manufacturing plants and engineering/consulting firms in the U.S. To apply for qualified reader subscriptions, please fill in the reader response cards herein and mail or fax or go to www.airbestpractices.com. To non-qualified subscribers subscriptions are $65 in Canada and $95 for other countries. When available, extra copies of back issues are $4 plus shipping. Contact Patricia Smith for subscription information at tel: 412-980-9902 or email: patricia@airbestpractices.com. REPRINTS: Reprints are available on a custom basis, contact Patricia Smith for a price quotation at tel: 412-980-9902 or email: patricia@airbestpractices.com.

THE MARKETPLACE

TECHNOLOGY

COMPRESSED AIR BEST PRACTICES®

THE MARKETPLACE ADVERTISING RATES

MAGAZINE ADS

For smaller classified-type ads use the following rates per column inch:

1x per year:	$94.00*
3x per year:	$90.00*
12x per year:	$84.00*

*reversed ads = 1.5x normal price

Add $50.00 to post the job opening on www.airbestpractices.com when you purchase an ad in the magazine

Contact Rod Smith for 4 color full page, 1/2 page and 1/3 page ad rates

rod@airbestpractices.com,
tel: 412-980-9901

"A team like ours runs on adrenaline ... and on clean, reliable compressed air."

—**J. D. Gibbs**
Team President – Joe Gibbs Racing,
technology partner with Kaeser Compressors since 1998

JOE GIBBS RACING

Nobody knows a winner better than Joe Gibbs Racing. That's why they've installed Kaeser compressed air systems in their state-of-the-art raceshop.

Reliable air is the lifeblood of Joe Gibbs' operation – just as it is in yours. From CNC milling centers to the fab shop and everywhere else in your plant, Kaeser provides all the clean air you require to keep you running at peak performance, 24/7.

Available in any size you need, our units are engineered for easy maintenance and energy efficiency ... but most of all, for ***reliability***. So, when you want a winner, choose Kaeser.

KAESER COMPRESSORS
Built for a lifetime.™

(866) 516-6888
www.kaeser.com/sigma
info.usa@kaeser.com

Member of CAGI Compressed Air and Gas Institute www.cagi.org

Certified Management System ISO

Kaeser Compressors, Inc., P.O. Box 946, Fredericksburg, VA 22404 USA