Oil-free Boosters | The Dirty Thirty | Maintenance Saves Energy

February 2011

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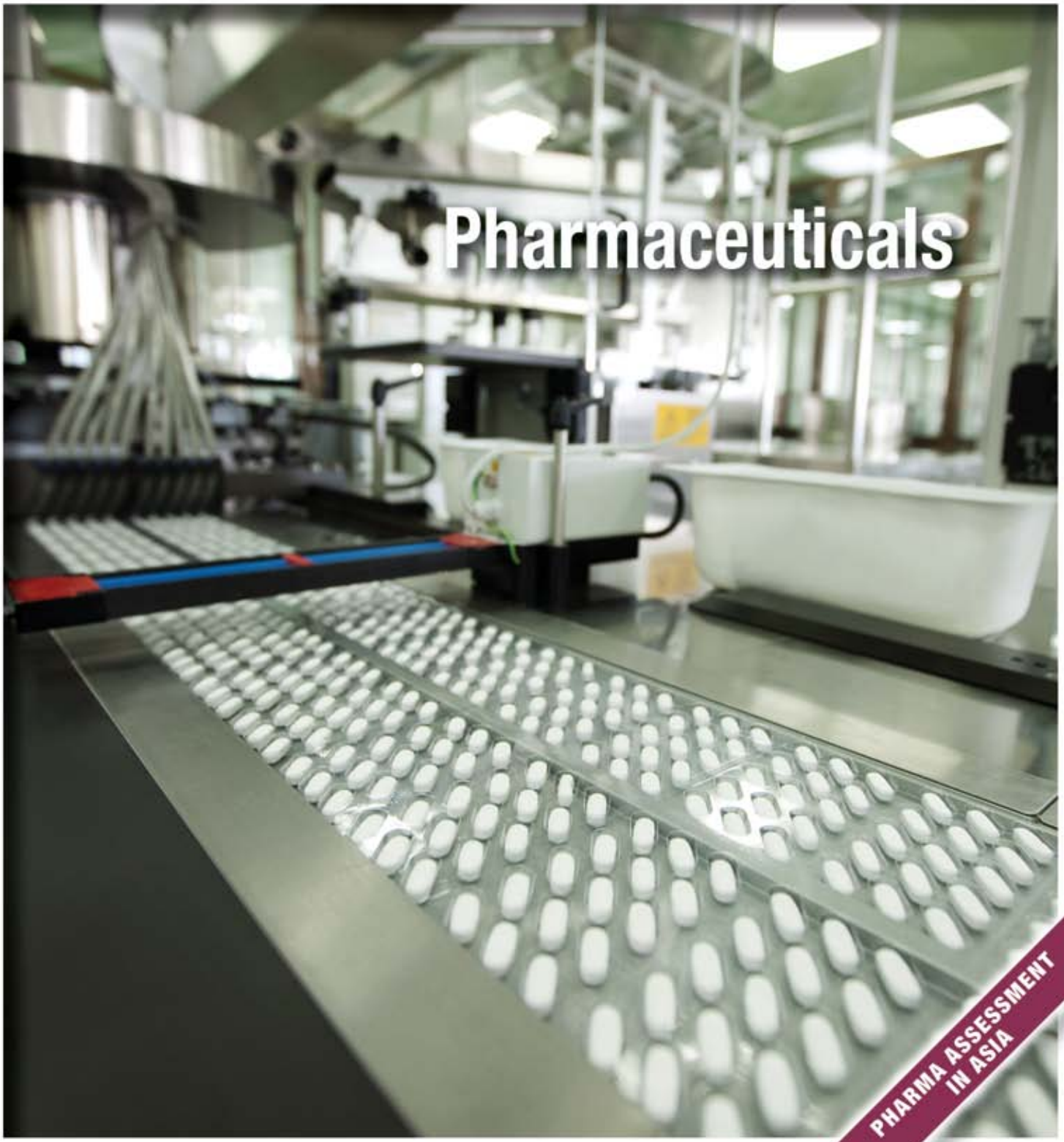

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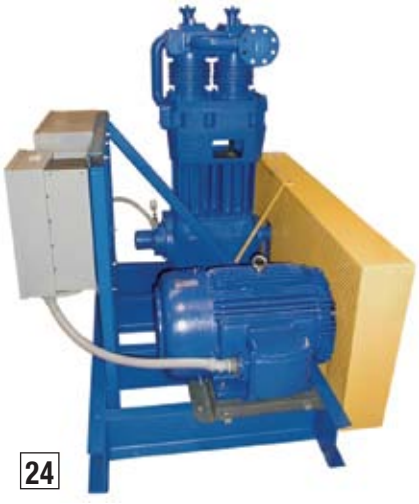
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FROM THE EDITOR

Pharmaceutical System Assessments

Tom Taranto, a Compressed Air Challenge® Instructor, uses a great term in one of our articles this month, "The Dirty Thirty", to describe the compressed air piping and fixtures on the demand side of the system. The last thirty yards of compressed air piping is where end users consistently find SIGNIFICANT compressed air leaks and pressure drops. The unnecessary energy costs incurred, in the dirty thirty, are very significant.

Maintenance staffs play a large role in managing the dirty thirty and can greatly contribute to reducing energy costs associated with compressed air. They are the ones with the tools, fittings and know-how to repair a costly compressed air leak. Maintenance can conduct low-cost, fast-payback projects to upgrade venturis and upgrade pneumatic air cylinders with ones that will consume 50% less compressed air. Maintenance can replace those 1/8th inch diameter hoses feeding compressed air (with a huge pressure loss) into production equipment — with 1/4 inch diameter hoses.

Is your maintenance staff on board with "Maintenance Can Save Energy"? Alan Bandes, from UE Systems, told me once, "Maintenance staffs must have the proper compensation programs in place for effective compressed air leak management. We have seen situations where compensation was actually reduced for maintenance staff identifying and replacing compressed air leaks."

The role of Maintenance to create energy savings in the piping systems' "Dirty Thirty" is so critical that we have created a new monthly column dedicated to this topic. The first installment, of this column, is about Advanced Air Leak Detection Services, a new service company in Northern California solely dedicated to identify and repair compressed air leaks.

The System Assessment of the Month, provided by Hank Van Ormer, also provides examples of three low-cost "Dirty Thirty" demand-side projects realized at a pharmaceutical plant. These projects provided energy savings of over $70,000 per year — with very low expenditures.

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

ROD SMITH
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> **"Point of use piping, valves, FRL's and all components that make up the last dirty thirty need to be sized to handle the 80 cfm peak airflow rate, not 20 cfm rate of flow."**
>
> **— Ron Marshall for the Compressed Air Challenge®**

SUSTAINABLE MANUFACTURING NEWS

Lilly, Pfizer, Johnson & Johnson, Bristol-Myers Squibb

SOURCED FROM THE WEB

Lilly Environmental Sustainability

As a company, Lilly is on track to improve the energy efficiency of its operations and reduce the corresponding greenhouse gases by 15% by 2013. The company is ahead of schedule in achieving its goals of a 40% reduction in the amount of waste sent to landfills and a 25% reduction in water intake.

Since announcing its environmental goals in 2009, Lilly has seen a 5% improvement in energy efficiency with a corresponding reduction in greenhouse gases. The company has reduced the amount of waste sent to landfills by 56%. Additionally, Lilly has achieved a 30% reduction in water intake. All improvements are over the 2007 baseline year.

We have established an Energy, Waste, and Water Reduction Fund to help fund capital projects at our facilities globally that will further our efforts to reduce the company's energy use. Since 2006, over $29 million has been invested in these projects, resulting in a $16 million annual savings.

The following projects alone have saved the company almost $650,000 per year and enough energy to power over 350 homes.

Lilly Corporate Center:
Installation of energy-efficient biosafety cabinets. These cabinets pull the air out of laboratory and put clean air into the workspace. They were chosen both to meet the safety needs of employees working in the lab and because of their energy-efficiency.

Fegersheim Manufacturing Facility:
Installation of HVAC modifications controlling when the system brings in fresh air. The modifications mean that the system will only run when there are people in the rooms. When the rooms are empty, the system will not run and energy will be saved.

Puerto Rico Manufacturing Facility:
Optimization of boiler feed water pumping. A large pump had been running with a small load, and was therefore inefficient. Smaller pumps were installed to run with the load at optimal efficiency and save energy.

Speke Manufacturing:
Consolidation of redundant chilled water/glycol systems. Instead of having multiple chillers running with small loads, the load was given to fewer chillers. This reduced redundancy and improved efficiency.

Source: www.lilly.com/responsibility

Avoid the Side Effects of...

… Excessive Energy Costs, Lost Production & Contamination with Pneumatic Products!

Many pharmaceutical manufacturing processes operate on a lot-basis. Large quantities of raw material pass from one process step to the next. The secondary manufacturing process responsible for turning active pharmaceutical ingredients into the end product utilize process air through pneumatic equipment.

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- **Reliable equipment up-time**

and...

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SUSTAINABLE MANUFACTURING NEWS

Lilly, Pfizer, Johnson & Johnson, Bristol-Myers Squibb

Pfizer Responsibility

Our mission is to procure and use energy at Pfizer in an efficient, cost-effective and environmentally responsible way. As an industry leader in energy management, we have made public our goals and commitments for energy efficiency and climate change management:

- Reduce CO_2 emissions by 20% (absolute) by 2012
- Improve energy efficiencies by setting an internal target of 5%
- Develop and apply clean energy technologies

Notable actions underway to meet our goals are:

- Improving energy efficiency throughout business operations
- Promoting leadership in energy management and environmental stewardship by appointing an "energy champion" at each site
- Increasing colleague awareness and engagement with a culture of conservation
- Undertaking site/building energy assessments and conducting Good Energy Management Practices training globally

These steps have the added benefit of improving operational efficiency, reducing energy costs, reducing product costs and enhancing Pfizer's reputation as a responsible corporate citizen.

Our Clean Energy Goal has been very challenging to reach. We are proud of obtaining more than 21% of our electricity from clean energy sources as of 2010. The shortfall from our original goal is due to a number of factors, including closure of certain plants with cogeneration technology and the financial viability of current clean energy technologies. Pfizer remains committed to aggressive development and use of clean energy technology where it makes business and environmental sense.

Johnson & Johnson Climate Friendly Energy Policy

Johnson & Johnson has a *Climate Friendly Energy Policy*, goals to reduce both facility- and transportation-related emissions, and a carbon dioxide (CO_2) reduction capital funding process that provides $40 million per year for energy and greenhouse gas reduction projects across the Company. In 2009, 17 new projects were approved. We also adopted a policy mandating that all new construction projects be certified to the widely used Leadership in Energy and Environmental Design (LEED) green-building standard, or equivalent.

Facility CO_2 Emissions

Our *Healthy Planet* climate change goal is to reduce our baseline 1990 CO_2 emission levels by 7% in absolute terms by 2010, and we are currently meeting this goal with a 16% absolute reduction (see chart). We experienced sales growth of more than 450% during the same period.

ENERGY USE *Gigawatt hours (GWH)*

	DIRECT	INDIRECT	TOTAL	% FROM RENEWABLE ENERGY SOURCES
1990	1,527	1,339	2,866	0 percent (baseline)
2006	1,811	1,975	3,786	37 percent
2007	1,818	2,030	3,848	36 percent
2008	1,882	2,019	3,903	34 percent
2009	1,800	1,943	3,743	39 percent

CARBON DIOXIDE NET EMISSIONS *Thousand metric tons*

	DIRECT	INDIRECT	INDIRECT OFFSETS	NET EMISSIONS
1990	308	751	0	1,059
2006	341	936	395	883
2007	344	972	385	932
2008	357	968	364	963
2009	337	940	386	891

HOW WE ARE ACHIEVING OUR CARBON DIOXIDE GOAL
CO_2 Reduction Projects Since 2005

Energy efficiency	27
Chiller upgrades	16
Solar PV/thermal	15
Cogeneration	7
HVAC	7
Boiler upgrades	4
Biomass	3
Wind	1

As of December 2009, 80 energy-reduction projects had been approved since 2005 and 62 completed. For approximately $187 million in capital, we anticipate these projects will collectively reduce CO_2 emissions by 129,000 metric tons annually and provide an internal rate of return of nearly 19 percent. To date, these projects have resulted in approximately 247,000 megawatt hours of cumulative energy savings per year. It should be noted, however, that some of these projects have left the portfolio as facilities have been closed or sold.

Greening Our Fleet — Local Action for Global Operations

Projects to reduce the impact of our nearly 39,000 automobiles began in 2007. Selecting smaller vehicles with appropriate engine sizes for each use is the fastest way to reduce the fleet footprint. Pfizer also is actively testing alternative fuel vehicles in the U.S., with plans to change our entire Japanese fleet of 2,200 vehicles to be hybrid fueled by 2012. Our goal is to lower vehicle emissions by an average of 5% annually through 2012. We are ahead of our target and reduced emissions 12% in 2009.

In addition, we're teaching principles of "eco-driving": Fuel economy improves by up to 30% through better driving and maintenance. Drivers who accelerate gradually and maintain steady speeds are also safer.

Source: www.pfizer.com/responsibility

Strategies include improving energy efficiency, installing on-site cogeneration and renewable-energy infrastructure, and purchasing green power and carbon offsets. Notably, we plan to triple our on-site solar power capacity from 4 megawatts to 12 megawatts through seven solar-power projects that will be completed in 2010.

Our challenge continues to be reducing absolute emissions while our businesses are growing. We use offsets to support renewable-energy projects and reduce greenhouse gas emissions through external projects, although we prefer to reduce our direct emissions and continue to seek ways to accomplish this. The chart to the right includes our energy use and emissions data; our Carbon Disclosure Project report, at www.cdproject.net, provides additional data.

Source: http:/www.investor.jnj.com

Johnson & Johnson

SUSTAINABLE MANUFACTURING NEWS

Lilly, Pfizer, Johnson & Johnson, Bristol-Myers Squibb

"We take our commitment to economic, social and environmental sustainability seriously, and extend this expectation to our partners and suppliers."

— Bristol-Myers Squibb Company Commitment

Bristol-Myers Squibb Sustainability 2015 Goals

Bristol-Myers Squibb is taking another significant step forward on the road to sustainability.

For Bristol-Myers Squibb, sustainability means conducting our business to help patients prevail over serious diseases in a manner that contributes to economic growth, social responsibility and a healthy environment now and in the future. As it expressly states in the company Commitment: "We take our commitment to economic, social and environmental sustainability seriously, and extend this expectation to our partners and suppliers."

During the past two decades, Bristol-Myers Squibb has been recognized as an industry leader in setting innovative and ambitious environmental and sustainability goals, and sharing the company's annual progress in meeting these goals with the public. Among these recognitions have been Newsweek magazine's Green Ranking and listing among the leading sustainability-driven companies in Corporate Responsibility magazine's 100 Best Corporate Citizens.

Building on this foundation, Bristol-Myers Squibb is now implementing a new set of five-year goals that will strengthen the company's fundamental business and support its position as a sustainability leader.

Bristol-Myers Squibb
Together we can prevail.™

SUSTAINABILITY 2015 GOALS	
GOAL	**BY 2015 WE WILL**
To our patients and customers	
Address focused unmet medical needs to improve health	Develop and commercialize medicines that address serious diseases Improve health outcomes by partnering to strengthen health care infrastructure, services and education Increase transparency and access to information on our medicines
Enhance the environmental and safe handling aspects of our medicines throughout their life cycle	Integrate design principles (e.g., green chemistry and safe handling) throughout new product development and commercialization Reduce packaging waste by 5%
To our employees:	
Provide a safe and healthy work environment	Achieve injury and illness rates in top 25% of pharmaceutical industry performance, with rates improving
Achieve a high performing work force as a recognized employer of choice	Build and develop a globally diverse leadership and talent pipeline to drive innovation
To our global communities:	
Increase key supplier sustainability aligned with our Commitment	Expand principles of sustainability and performance indicators at key suppliers
Educate and engage our organization to actively drive progress in environmental and social responsibility	Increase employee understanding and commitment to implement sustainability initiatives
To our environment:	
Improve the environmental footprint of our company	Reduce total energy use and greenhouse gas emissions by 15% Reduce total water use by 10%
To our shareholders:	
Financial benefits, enhanced reputation and risk reduction	

For Bristol-Myers Squibb, sustainability is much more than meeting environmental mandates. The company's approach to sustainability is comprehensive and global, and encompasses the products we make and how we make them, our facilities, our employees and our communities. We continually challenge ourselves to higher standards, and now we have set our course for the next five years: the Sustainability 2015 Goals.

Sustainability 2015 Goals

The Sustainability 2015 Goals address a broad spectrum of company responsibilities to its stakeholders — patients and customers, employees, global communities, shareholders and the natural environment.

It is intended that these goals will focus attention on those areas that are of great importance for the future success of the company's BioPharma strategy and for the health and well-being of the global community.

Bristol-Myers Squibb developed these goals through a rigorous process, with the active participation of employees representing Research and Development, Technical Operations, Commercial Operations, Public Affairs, Human Resources, the Bristol-Myers Squibb Foundation and other staff functions. The goals were benchmarked against those of other companies in the biotech, pharmaceutical and other industry sectors, and were developed considering key issues and expectations of company stakeholders. The goals were reviewed and approved by Chief Executive Officer Lamberto Andreotti and the company's Senior Management Team.

Source: www.bms.com/sustainability

THE SYSTEM ASSESSMENT

Three Demand-Side Projects at a Pharmaceutical Plant

BY HANK VAN ORMER, AIR POWER USA

Introduction

This pharmaceutical plant spends $265,100 annually on energy to operate the compressed air system at their facility. This figure will increase as electric rates are projected to be raised from their current average of 7.7 cents /kWh. The set of projects identified in the compressed air system assessment could reduce these energy costs by $139,300 per year (52%). In addition, these projects could enhance productivity and quality. Estimated costs for completing the supply and demand-side projects total $84,350, which represents a simple payback of eight months.

For this article, we will detail the demand-side projects identified at this pharmaceutical plant. The projects include implementing a leak management system, installing automatic shut-off valves on equipment, and addressing inappropriate uses of compressed air. The benefits to the facility are a compressed air use reduction of 504 scfm translating into a potential energy savings of $70,056 per year.

PROJECT	SAVINGS PROFILE	ENERGY AND OTHER SAVINGS			TOTAL PROJECT COST ($)
		AVG KW	KWH	SAVINGS ($)	
DEMAND-SIDE SYSTEM					
Implement ongoing leak management program	135 scfm	30.22	243,712	$18,765 /yr.	$4,850
Install automatic shut-offs on equipment; 50 valves — electric motorized ball valves	190 scfm	42.53	342,961	$26,410 /yr.	$25,000
POTENTIALLY INAPPROPRIATE AIR USES					
Replace open blows with Venturi nozzles or timed shut-off to cycle with product	179 scfm	40.13	323,608	$24,881 /yr.	$4,000
TOTAL	**504 SCFM**	**112.9 KW**	**586,673 KWH**	**$70,056**	**$33,850***

*Costs do not include necessary supply-side compressor control adjustment costs.

Supply-Side System Background

This pharmaceutical plant has been operational for 45 years. The compressed air system has been modified many times over the years.

The plant packages liquid and solid-type pharmaceutical drugs. The compressed air system is anchored by five Atlas Copco non-lubricated, two-stage rotary screw air compressors. The units are of various ages ranging from being manufactured in the mid-1970s to the mid-1990s. The units are one 100 hp unit, three 150 hp units and one 200 hp unit. They are all water-cooled with aftercoolers. They currently use plant-supplied 42 °F chilled water for their system. All units are in good working condition.

The compressed air goes to a 2,100 scfm blower-purge desiccant dryer (with pre- and after-filters) and to a dry 2,200-gallon air receiver installed outside with a single point connector. The dry air goes through a non-brand pressure regulator/flow controller designed to hold a 2 psig pressure swing to the plant with a 4 psig pressure loss or drop at rated flow.

The compressor capacity controls are all controlled by a "custom-built" central control sequencing system installed in Allen Bradley hardware. There are operating problems with both the flow controllers and the control system.

Demand-Side Project #1:
The Compressed Air Leak Survey

A survey of compressed air leaks was conducted at the plant and 41 leaks were identified, quantified, tagged, and logged. Potential savings totaled 135 cfm, an average of 3.2 cfm per leak.

An ultrasonic leak locator was used to identify and quantify the compressed air leaks. This tool was a VXP AccuTrak manufactured by Superior Signal. Estimation of leak size was achieved by noting the intensity of the signal by the operator, type of leak, and observation. The estimates are made on a conservative basis

Leak locating during production time with the proper equipment is very effective and often shows leaks that are not there when idle.

THE SYSTEM ASSESSMENT

Three Demand-Side Projects at a Pharmaceutical Plant

The benefits to the facility are a compressed air use reduction of 504 scfm translating into a potential energy savings of $70,056 per year.

LEAK LIST				
NO	LOCATION	DESCRIPTION	EST SIZE	EST CFM
1	Line 20	Manifold	S	2
2	Line 20	Cylinder Down From 1	S	2
3	Near # 2	Blow Gun	S	2
4	Down from # 3	Regulator	S	2
5	Next to # 4	Blow Gun	S	2
6	Line 21	Seal Kicker Back	S	2
7	Line 21	Solvent Blow Gun	S	2
8	Line 22	Union Under line	M	5
9	Line 15	Blow Gun Hose	S	2
10	Line 13	Filter Before Filler	S	2
11	Line 13 Bottle Feed	Bowl Trap Leak	S	2
12	Line 14 Bottle Feed	Filter Drain	M	5
13	Line 14 After Capper	Trap	M	5
14	Line 14 next to 13	Valve Stem	S	2
15A	Line 14 near capper	Fitting	S	2
15	Line 11 Venturi Fit	Fitting	M	5
16	Line 14	Regulator Gauge	M	5
17	Line 11 To blow	Fitting	M	5
18	Line 11	Inside Machine	L	10
19				
20	Comp Room # 3	Valve Stem	M	5
21	Pall Dryer Next Arrow	Behind Panel	M	5
22	Comp Room	Arrow dry Fitting	S	2
23	Comp Room Pall	Moisture Indicator	S	2
24	Pall Dryer near #5	Gauge	M	5
25	Next to 24	gauge	S	2
26	Comp Room	Gauge Reg Back Door	M	5
27	Coating Room 2	Blow Gun Fitting	S	2
28	Coating Room 1	Blow Gun Fitting	S	2
29	Coating Room 3	Blow Gun Fitting	S	2
30	Acella Coat Room 2	Fitting/ QDC	S	2
31	Coat Quick Sieve #5	Fitting Filter	S	2
32	Liquid Line 1	Crack Bowl	M	2
33	Liquid Line 1	Elbow	S	2
34	Line 2 Liquid	Stainless Fit Union	M	5
35	Line 1 Near shrink	Union	M	5
36	Line 2	union under Bot. clean	M	5
37	Line 3	Blow Gun Union	M	5
38	Line 3	Elbow/shrink wrap	S	2
39	Line # 3 4oz	Comp. Fitting By x ray	M	5
40	Near # 39	Regulator on Labeler M	S	2
41	Line #4 before fill	Tube Fit by Drop line	M	2
42			Total scfm	135

and probably understate the magnitude of the volume of leaks. The results of the leak survey are summarized and tabulated.

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 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 to 95% of the total leaks will be 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 open blows that shield 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.

Project #1 Summary

Estimated reduction of air flow	135 cfm
Recoverable savings from air flow reduction	$139/cfm yr.
Annual electric cost savings	$18,765 /yr.
Cost of leak detection equipment	$2,800
Unit cost of leak repairs — 41 leaks ($15 materials /leak; $35 labor /leak)	$2,050
Total project cost (materials and installation)	**$4,850**

THE SYSTEM ASSESSMENT

Three Demand-Side Projects at a Pharmaceutical Plant

Demand-Side Project #2: Automatic Equipment Shut-Offs for the Bottling Line

Shutting off the air supply to machinery, when not in use, can minimize the most significant leaks in any high-production plant. When such leaks are found, there are economical and easy methods to shut-off air supply automatically.

Slow-acting, electric-operated, automatic ball valves can be installed in the main feed line to a piece of equipment and wired so it will open and close whenever the machine is powered up or shut off. The table below lists locations where automatic shut-offs may be of use, either as individual machine shut-offs or as zone valves.

The bottling lines (15, 13, 14, 11) probably run only about 50% of the time due to scheduling, job change, repairs, etc. During our site visit, we observed four machines turned off, but still using air. We believe automatic shut-off valves would create significant savings in compressed air use. The average estimated flow is 50 cfm. This is in the form of high-thrust blowers, blow nozzles, and 1/8" blow tubes.

Project #2 Summary

Number of automatic equipment shut-off valves	50
Estimated total reduction in average air flow	190 cfm
Recoverable savings from air flow	$139 /cfm yr.
Annual electric cost savings with proposed project	$26,410 /yr.
Cost per shut-off valve (materials and installation)	$500
Project cost (materials and installation)	$25,000

POTENTIAL EQUIPMENT SHUT-OFF OPPORTUNITIES

	LOCATION	DESCRIPTION	SIZE (CFM)	USAGE (%)	NET SAVINGS (AVG CFM)
#1	Lines 15, 13, 14, 11	Avg 50 cfm each x 4	200	50	100
#2	Four liquid lines	About 8 units	100	50	50
#3	Packet line	2 lines	200	20	40
				TOTAL	**190**

Demand-Side Project #3: Blow Offs

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

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

Plants with many 1/8 and 1/4 inch lines running as blow off on units will use approximately 10 and 25 cfm each, respectively, at 60 psig.

During our site visit, we observed four machines turned off, but still using air. We believe automatic shut-off valves would create significant savings in compressed air use.

One savings approach is to use an **air amplifier**, which requires less compressed air. Air amplifiers use "Venturi" action to pull in significant amounts of ambient air and mixing it directly into the 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 blow off air to the process and generate a savings of a 15 cfm compressed air per 1/4" blow off. Savings may be available using 1/8" lines, but the cost effectiveness will not be as great.

Project #3 Summary

Estimated air reduction	179 scfm
Electrical energy cost recoverable	$139 cfm/yr.
Total electric energy cost recovery	$24,881 /yr.
Estimated cost of 80 nozzles	$4,000

Conclusion

The demand-side projects identified include implementing a leak management system, installing automatic shut-off valves on equipment, and addressing inappropriate uses of compressed air. The benefits to the facility are a compressed air use reduction of 504 scfm translating into a potential energy savings of $70,056 per year. BP

For more information please contact
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A VIEW FROM SOUTHEAST ASIA

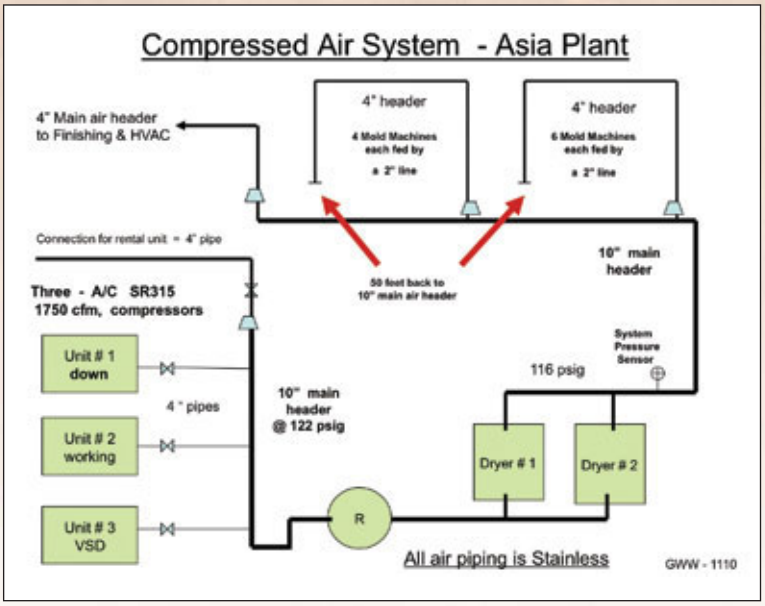
A Pharmaceutical System Assessment

BY GARY WAMSLEY, JOGAR ENERGY & UTILITY SERVICES

We estimated energy savings of 403,500 kWh per year for a power savings of $65,000 per year.

Supply-Side Overview

This plant was built and started-up in 2006. It has three 315 kW Atlas Copco ZR315 rotary screw (non-lube), water-cooled air compressors. One unit has a variable speed drive and it is used to control air pressure in the main 10" header that supplies the adjacent critical manufacturing process. A multiple compressor control system was included with the project. The installation was quite impressive. The equipment is robust and maintenance is very good.



The air compressor motors operate at 1,450 rpm (with 50 cycle power) providing about 1,700 scfm each. A 1,500 liter receiver tank supplies two 1,800 cfm regenerative desiccant air dryers installed in parallel. The dryers have an electric heated blower that uses 70 cfm of compressed air as part of the regeneration valve-sequencing operation. The facility operates on a 24-hour, 7 day a week schedule. Two machines are normally in service.

We conducted a comprehensive compressed air system assessment. Opportunities to improve the system were found in the main piping system, in reducing pressure losses in the mold machine piping, and with the high ambient temperatures found in the compressor room. We estimated energy savings of 403,500 kWh per year for a power savings of $65,000 per year. The total projects costs were $48,000 for a simple ROI of nine months.

Pressure Swings in the Main Piping System

The compressors were operating at 120–124 psig — a pressure well above the system pressure necessary for this type of facility. All crucial process equipment is designed to operate satisfactorily at 84–88 psig inlet to the machine regulators.

A "defective product" recall had recently resulted in raising system air pressure from a nominal 108 psig to 118 psig. We determined that the air compressors should be able to operate at 100–104 psig discharge pressure and adequately provide a minimum 90 psig in the 2" main lines that supply each of the ten critical-process molding machines.

Line pressure drop from the compressor room air dryers to these machines was calculated to be only 2–3 psig. When we also include filters and manifold valves, we saw a 5–6 psig pressure drop. This air treatment system is performing very well — providing high quality air with an appropriate pressure drop.

A VIEW FROM SOUTHEAST ASIA:

A Pharmaceutical System Assessment

The heated desiccant air dryers, with pre- and after-filters provided a reliable pressure dew point of -40 °F, with a low system pressure drop, for this pharmaceutical plant.

The two main 4" air lines (located directly off of the 10" main header) supply the manufacturing bay with six molding machines on one loop and four machines on the second loop. Two additional machines are planned for the second area in 2011.

We determined that, due to a semi-loop configuration of these 4" air lines supplying the molding machines, it required only 50 feet of additional 4" pipe on each loop to connect back into the 10" main header. This would eliminate all doubt of machines at the end of the loop experiencing low pressure. Due to the additional planned machines, plant personnel agreed to proceed with this modification. The cost for the piping changes was $9,000.00.

Process air demand was generally very uniform. Each key molding process machine uses between 75–100 scfm. Other plant compressed air uses (finishing, HVAC, maintenance, leaks, etc.) were determined to have no significant surge conditions.

Nevertheless, the main 10" air header was experiencing pressure swings of 5–6 psig on a regular basis. We determined that the swings were due primarily to the compressed air dryer tower regeneration sequencing valves and the slow-responding air compressor pressure controls. The air compressor load controls (both the direct drive units and the VSD unit) were not programmed to be able to maintain the system header pressure within the expected 2–3 psig range with a steady plant air load of only 2200–2400 scfm (with two units in service).

To solve this, the decision was made to hire Atlas Copco service personnel to inspect the equipment and re-configure the air compressor

Gary W. Wamsley

Gary W. Wamsley is President of JoGar Energy & Utility Services, Inc. a small Atlanta-based Consulting Firm that specializes in **"On-Site" Energy Assessments & Utility System Reviews** for commercial and industrial plants. He also conducts technical training for engineers and utility personnel. He is a Mechanical Engineer with 40 years of management, technical staff and plant operational experience in large and small facilities for the tire & rubber, aerospace and pulp & paper industries.

- A Registered Professional Engineer in four states
- A Certified Energy Manager with AEE
- A Certified Plant Engineering Manager

He recently served as a technical consultant for a Fortune 100 company coordinating their energy program, conducting plant energy reviews, boiler plant optimization, process system assessments and implementing energy projects in over 120 facilities worldwide.

The reconfigured air compressor controls were able to capitalize on the lower pressure requirements and deliver an estimated air compressor energy savings of 293,400 kWh per year.

and air dryer control systems and valving. The estimated project cost was $18,000. Please note that this compressor control investment was necessary to capitalize on the system improvements detailed further on in this assessment.

Pressure Drops in the Mold Machine Piping

The reported low air pressure condition in a key zone of each molding machine was determined to be due to local piping restrictions at the main air regulator valve. A ¾ inch size plastic air hose (with ½" I.D. pipe nipples) connected the 2" air supply pipe to the 1¼" size regulator on the machine. We recommended changing this 18" long hose to 1½" size on each machine and to also use less restrictive hose/pipe fittings. The cost was $200.00 for each machine for a total project cost of $2,000.00.

Each one of these molding machines was experiencing a pressure drop of 16 psig due to the restrictive hose/piping arrangements! A system pressure reduction of 16 psig (from 116 psig nominal to 100 psig) equaled an energy savings of 8%. The reconfigured air compressor controls were able to capitalize on the lower pressure requirements and deliver an estimated air compressor energy savings of 293,400 kWh per year. This equals approximately $47,000 of air compressor motor power savings per year.

Reducing Ambient Temperatures in the Compressor Room

Located in Southeast Asia, this plant experiences average annual ambient outdoor temperatures ranging from 85 to 95 °F. Rain can be a daily occurrence for half of the year. Heat and humidity are serious issues for air compressor and air dryer efficiency in these conditions.

The compressor room was an enclosed concrete building with the main electrical MCC switchgear adjacent to the equipment. The large roll-up access door was kept closed and locked (safety rules). Good-quality supply and exhaust air ducts can be provided. The ambient air supply, however, was hot outdoor air. The air compressors are water cooled, thus air line piping temperature was not an issue. However, the compressor room ambient temperature was over 100 °F on a continuous basis.

A VIEW FROM SOUTHEAST ASIA:

A Pharmaceutical System Assessment

The air compressors were experiencing air intake temperatures above 100 ˚F. Installing exhaust ventilation duct work on the air compressor helped lower ambient temperatures in the compressor room.

The desiccant air dryer was exhausting 230 ˚F hot, humid air into the compressor room during the 4-hour regeneration cycle.

The goal was to reduce the average compressor intake temperature by 30 ˚F! We accomplished this in three steps.

1. Remove heat generated by the air compressors by modifying the exhaust ventilation duct work in the compressor room by connecting directly to each air compressor and capturing the 140–145 ˚F hot air from the compressor enclosures at the top of each unit. Remove this HOT air from the compressor room by utilizing the existing *room exhaust duct* system.

2. Remove heat generated by the heated desiccant air dryer by modifying the air dryer regeneration exhaust piping (hot regeneration air issues) and by insulating the tops of the towers. Currently, the hot, humid regeneration air is being exhausted into the compressor room. We will remove this exhaust air by connecting it to the existing room exhaust duct system. We will also insulate the upper parts of the air dryer towers which reach temperatures of 200–210 ˚F when in regeneration mode. These two actions will reduce ambient heat and humidity inside the compressor room so the machines can operate more efficiently.

3. Connect the room *ambient air supply unit* into the adjacent HVAC machine room that has an ambient of 75 ˚F (due to numerous large chilled water lines and AHUs in the room).

The total air duct modification costs for the three air compressors is estimated at $15,000. The cost for 30 feet of 10" insulated steel pipe discharge pipe and a thermal insulating mat on top of each dryer tower is $4,000. Achieving a 30 ˚F colder ambient in the compressor room equals a 3% air compressor motor power savings. This equals savings of 110,100 kWh and $18,000 per year.

Summary

A compressed air system assessment of this type is not unusual for us. All of the supply-side equipment (air compressors and dryers) was operating well and was well maintained. The over-all system had also been given considerable thought and investment.

The primary opportunities for improvement lay in reducing the 16 psig of pressure losses found in the hoses and piping in each of the molding machines. The second area of opportunity was to reduce the ambient temperatures in the compressor room by 30 ˚F. Once these things were accomplished, modifications in the compressor controls were required to capitalize on the potential energy savings. We estimate energy savings of 403,500 kWh per year for a power savings of $65,000 per year. The total projects costs were $48,000 for a simple ROI of nine months. BP

For more information please contact Gary Wamsley, JoGar Energy & Utility Services, Tel: 770-343-9757, email: gary.wamsley@comcast.net, www.jogarenergy.com

Achieving a 30 ˚F colder ambient in the compressor room equals a 3% air compressor motor power savings. This equals savings of 110,100 kWh and $18,000 per year.

THE TECHNOLOGY PROVIDER

Oil-free Booster Compressors Aid Pharmaceutical Packaging

BY ROBERT JAMES AND MATT LOGAN, HYCOMP, INC.

In the realm of pharmaceutical production and packaging, the two most important factors with compressed air are *reliability and quality*. In pharmaceutical plants, our customers have emphasized this reoccurring theme over and over to paint the clear picture that reliable and high-quality air are king.

The Food & Drug Administration (FDA) has very stringent production process regulations, put in place to protect the public, and these rules must be followed. Product-damaging contaminates in compressed air, such as oil and mold-producing moisture, can cause complete production shutdowns, production disruptions, and expensive product recalls.

Reliable Air Compressors Required for Inhaled Insulin Packaging Machines

A major pharmaceutical corporation was still near the beginning of their trial phase for their inhaled insulin product line. They needed a compressed air system to supply clean and dry air for a packaging machine while it was not in operation. The pressurized air provided dehumidification for the inhaled insulin packaging machine when not in use to keep it free from mold.

If the compressed air system failed in any way and any contamination accumulated inside the packager, it would have to be cleaned out and re-certified by the FDA before production could continue. For this reason, the reliability of the air compressor was paramount as unplanned downtime would have been extremely costly.

The factory had been using a pair of scroll air compressors that were consistently failing. They decided to find a solution for this specific production line and selected a single 2AN61 Hycomp oil-free air compressor with the appropriate air treatment products. Installed in 2000, the system supported the drug trials continuing-on until this new form of insulin delivery was approved.

Oil-free Air Boosters for Blister Packaging

In 2006, a pharmaceutical plant in the northeast needed a flexible air booster system that could adapt to a changing demand of inlet and discharge pressures for a blister packaging process. Blister packaging is a form of blow molding, much like PET bottle blow molding is used to manufacture soda-pop bottles. In the pharmaceutical world blister packs are commonly used for packaging pills. This form of packaging is easy to identify, in the consumer's hands the packaging usually looks like a plastic bubble made to fit the pill inside with a metallic foil on the back.

Just as the PET molding process cannot allow any oil to contaminate the bottles, oil cannot be allowed to escape into the blister packs holding medicine. Hycomp designed a reliable triplex oil-free booster system to provide pressure flexibility without losing any flow — all while keeping the air stream pure and free of contaminants.

This AN68F Hycomp Oil-Free Nitrogen Booster was built specifically to provide clean and reliable nitrogen at the desired flow for a pharmaceutical manufacturing plant in Puerto Rico.

Nitrogen Boosters for Pneumatic Conveying and Packaging

A major pharmaceutical firm had completed construction on a new biotech bulk manufacturing facility in Puerto Rico in mid-2006. The 300,000 ft² facility produces a rapid-acting insulin product. The production of this product requires the use of recombinant DNA technology via insulin lispro (rDNA origin) injection. The plant purchased bulk-compressed nitrogen to power the pneumatic conveying and packaging systems required to produce this product.

THE TECHNOLOGY PROVIDER

Oil-free Booster Compressors Aid Pharmaceutical Packaging

A smaller compression ratio equates to smaller equipment and lower operating costs.

In 2008, the plant decided to switch to nitrogen generation for this process. The facility wanted to generate their own nitrogen to streamline their process and lower costs. Their process demanded 180 psig of nitrogen. Even though the inlet to discharge jump was relatively small (80–180 psig), it had to be pure of contaminates, and the flow needed to remain at 349 scfm. To meet their requirements, a nitrogen generation system was installed utilizing a Hycomp booster to provide the necessary elevated process pressure. This new generator system reduced their nitrogen costs by approximately 70% annually.

Air Booster Supports Catheter Manufacturing

A multinational pharmaceutical company is currently constructing a 48,000 ft² catheter manufacturing facility in Costa Rica that is slated for completion in late 2011 to early 2012. The company has been in Costa Rica since 2000, when they completed their first facility in San Jose. Their initial facility produces some of the most advanced medical products in the world, including catheters that control the administration of intravenous medicines.

Diego Ruiz, Outside Sales for FLOTEC, is working closely with the pharmaceutical company on providing the compressed air the manufacturing processes their new facility will require. Not only do the processes require 100% clean and reliable air, the footprint of the compressed air system is limited. A Hycomp Oil-Free Air Booster has been chosen to meet all of their air compressor criteria. "We needed equipment that fit in the area we had for it. Equipment that was not too large or too small and that could give us the high pressures our application requires. Hycomp had the only compressors that matched exactly what we needed, so it was an easy choice," Diego commented.

In this basic air booster setup there are receiver tanks on both the inlet and discharge of the booster and flex hose connections to the booster to provide pulsation dampening. This removes any pulsation or shockwaves from traveling back to the initial compressor and this setup delivers a smooth flow to the desired point of use.

Boost It

Air boosters and gas boosters offer a variety of solutions to the pharmaceutical industry. When higher pressures are needed and clean air is mandatory, a high quality booster is often the perfect fit. Standard compressed air systems in industrial facilities are typically designed for pressures of 80 to 130 psig. When higher pressures are required it is very effective to use a portion of the plant air and apply an air booster to obtain the desired pressure. Other methods of acquiring higher pressure air such as stand-alone air compressors, air amplifiers and increasing the pressure of the entire plant are more costly and far less efficient.

Air loss is not a problem with air boosters. What you put in is what you get out. Unlike pneumatically driven air amplifiers that can use up to 60% of your air flow to power the machine, air boosters are electric driven. So, if you put 100 scfm in, you are going to get 100 scfm out.

Using an air booster also allows you to use less horsepower and still get higher pressures. It takes more power to begin compression from ambient air. For example: when you are compressing air from 0 psig to 600 psig the compression ratio is 41.8. However, when compressing air from 100 psig to 600 psig the compression ratio is 5.4. A smaller compression ratio equates to smaller equipment and lower operating costs.

The size of an air booster is also an important factor for many clients who want high pressure while requiring a smaller footprint. Air boosters are typically much smaller than traditional stand-alone air compressors. A smaller machine makes the booster system less expensive to purchase, install, operate and maintain.

Oil-Free Is The Answer

Oil-less and oil-flooded compressors have their strengths and their weaknesses. An oil-less compressor can easily provide a clean air stream, however they are not continuous duty compressors and can really only provide lower pressures. A handful of oil-less compressors can provide slightly higher pressures and the manufacturers often claim continuous duty, but when run at higher pressures for extended periods of time they tend to have a consistent fail rate.

Oil-flooded compressors have no problem providing moderately high pressures continuously, due to their oil lubrication. The obvious downside to oil-flooded compressors is that by design, they push a substantial amount of oil into the air stream. This oil can be cleaned out, however, it is very costly to clean oil at high pressures and it is also maintenance intensive.

Oil-free reciprocating compressors combine the strengths of both the oil-less and oil-flooded compressors without any of their weaknesses. An oil-free compressor can provide a clean air stream, higher pressures and industrial continuous duty. The way Hycomp oil-free air and gas Boosters are able to accomplish the best of both worlds is to basically combine them — they are both oil-lubricated and oil-free.

"We needed equipment that fit in the area we had for it. Equipment that was not too large or too small and that could give us the high pressures our application requires. Hycomp had the only compressors that matched exactly what we needed, so it was an easy choice."

— Diego Ruiz, Outside Sales for FLOTEC

THE TECHNOLOGY PROVIDER

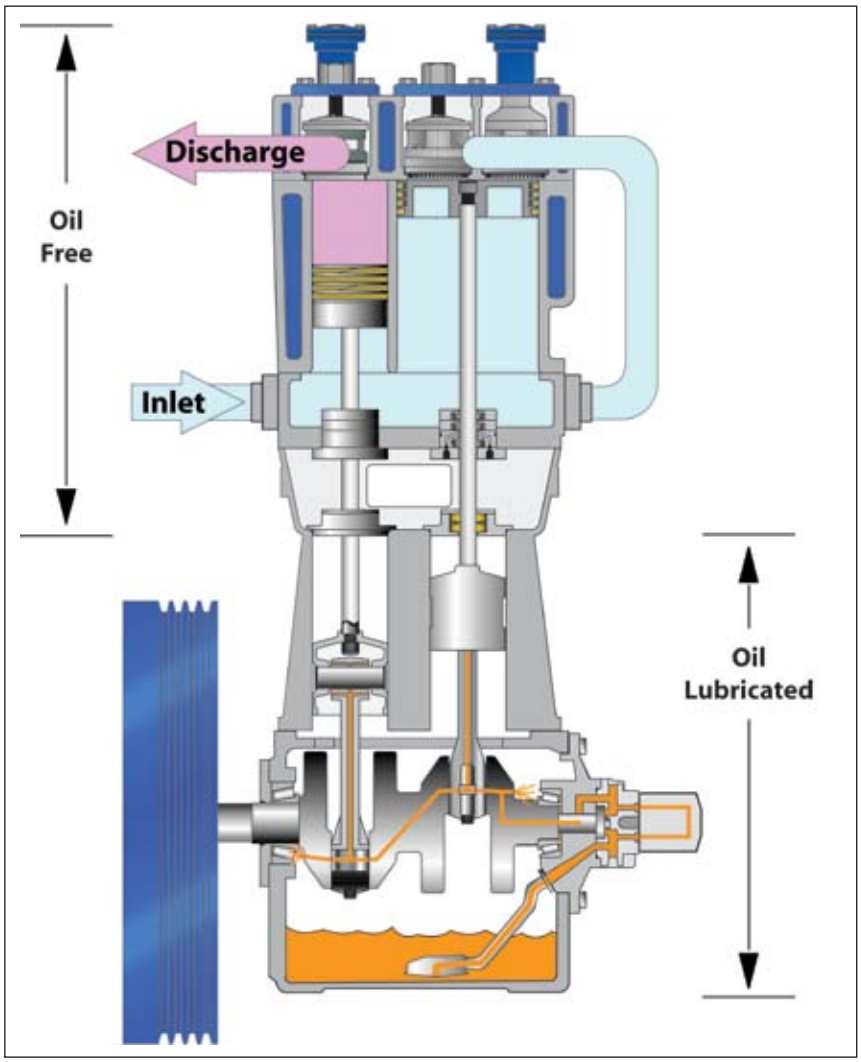
Oil-free Booster Compressors Aid Pharmaceutical Packaging

For the pharmaceutical industry, oil simply cannot be present in the process or final product. For that reason, reciprocating oil-free air and gas boosters are an excellent solution when the application requires clean and reliable gas.

Each Hycomp crankcase is oil-lubricated. That oil is fully contained in the bottom end of the compressor via oil scrapers and a distance piece. Oil never enters the heat of compression and therefore does not enter the gas stream. The compression end of the air compressor utilizes thick PTFE based piston rings and gas packings that are impregnated with other natural oil-free lubricants.

For the pharmaceutical industry, oil simply cannot be present in the process or final product. For that reason, reciprocating oil-free air and gas boosters are an excellent solution when the application requires clean and reliable gas. Reciprocating technology is nothing new, but when Hycomp specifically designs each compressor system individually for the intended application, the result is always clean and reliable. BP

For more information, please contact Robert James or Matt Logan, Hycomp, Inc., Tel: 435-563-3695, email: sales@hycompusa.com, www.hycompusa.com



Hycomp crankcases are pressurized to provide generous lubrication to all moving parts and bearings. Unlike splash lubrication that spreads oil sporadically, oil is liberally delivered with pinpoint accuracy. The Hycomp oil-lubricated bottom end decreases running temperatures, allows for higher discharge pressures and provides compressor longevity.

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MAINTENANCE SAVES ENERGY

Advanced Air Leak Detection Services

BY ED ATTANASIO

Jim Morgan, from Advanced Air Leak Detection Services, has conducted more than 2,000 compressed air system audits in Northern California.

Audits Shouldn't Always Recommend New Air Compressors

Until now, many companies in the compressed air industry have implemented an approach where inadequate compressed air pressure (often caused by air leaks) is addressed by adding more supply equipment to the compressor room. A new company, called Advanced Air Leak Detection Services (ALD), solves compressed air pressure issues by focusing on demand-side improvement opportunities in compressed air systems. "Leak audits often assume all leaks will be fixed and include the recommendation of a new air compressor capable of turning the reduced air demand into energy savings", says Jim Morgan of ALD. "The market seems to revolve around equipment sales and not system solutions and real results," he continues, "Most companies have focused more on the supply side of the system, which in the end means capital purchases. There are many sales people out there claiming to be professional auditors, but with all the pressures from their suppliers — all they end up doing is proposing new capital equipment."

According to Morgan, there is a problem with audits today where compressed air leaks are identified and tagged with the promise to reduce air demand. New equipment is purchased to better match demand, but all too often, the leaks, artificial demand and inappropriate usages are almost never repaired so the energy savings aren't realized.

ALD has the goal of simply turning existing air compressors off when possible, Morgan said. "Instead of adding supply equipment, we fix air leaks and incorporate high-efficiency air nozzles, blower packages, and point-of-use receivers." These demand-side actions stabilize compressed air system pressure and this ultimately increases production output, reduces production down-time and spoilage costs, and decreases the power costs of the compressed air system. According to Morgan, "The key to a successful leak audit isn't to identify the leaks. The key is to work alongside the maintenance staff to prioritize and schedule the repair of leaks, and then to maintain-the-gain."

Stabilizing Compressed Air System Pressure Boosts Production Output

Why is stabilizing compressed air system pressure so vital to production? "If you have a high-speed application like can manufacturing, for instance," Morgan explained. "And let's say the plant's pressure fluctuates between 100 and 115 psi, it can affect the bodymakers, the printing or the necker-flanger applications on the cans. When you produce 5 million cans in a 24-hour shift, steady pressure is critical. Often in today's world, production equipment is set up to run much faster than the manufacturer's-recommended speeds, which makes it more sensitive to air pressure. Any variations in pressure can cause the product to be off-spec and spoilage costs can and will skyrocket."

Leaks reduce compressed air pressure and increase spoilage costs in high-speed applications like can manufacturing.

> "Leak audits often assume all leaks will be fixed and include the recommendation of a new air compressor capable of turning the reduced air demand into energy savings."
>
> — Jim Morgan of ALD

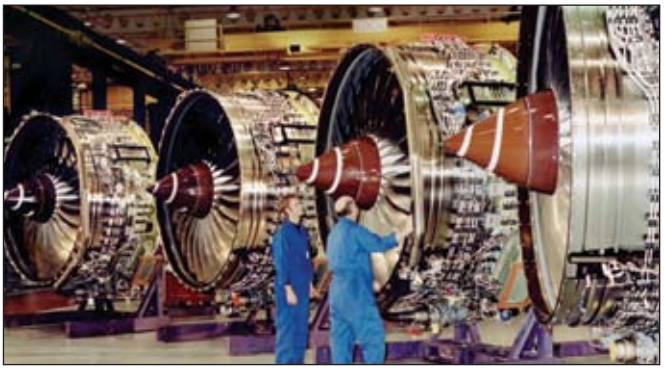
Leak Examples

MAINTENANCE SAVES ENERGY

Advanced Air Leak Detection Services

"The key to a successful leak audit isn't to identify the leaks. The key is to work alongside the maintenance staff to prioritize and schedule the repair of leaks, and then to maintain-the-gain."

— Jim Morgan of ALD



Aerospace manufacturing and testing facilities often experience unstable compressed air system pressures creating high energy costs.

Stabilizing Compressed Air System Pressure Reduces Production Down-time and Spoilage Costs

Unstable compressed air pressure creates significant product spoilage costs and production down-time. The presence of compressed air leaks, make it almost impossible to maintain steady system air pressure. "Stable air pressure is critical in industries such as foundries, food plants, and high-tech facilities," according to Morgan. "A foundry has large stamping equipment to form large pieces of metal, for instance. If they are making bicycle cranks, they strike the piece of metal two to three times on each side to form the crank. These huge stamping presses utilize large amounts of compressed air, and have to strike the metal with equal force each and every time. If air pressure is not stable spoilage costs are incurred, and the press can fault stopping production.

"The root cause of unstable compressed air system pressure is similar with all manufacturing facilities," Morgan said. "It's a combination of root causes usually — lack of storage, air leaks, inappropriate end uses, poor controls on air compressors and inadequate piping or drops. It all contributes to unstable and inconsistent system pressure at the point of use."

Compressed Air Leak Programs Save Energy and Dollars

According to a study done by the U.S. Department of Energy, compressed air leaks represent 20–28% of total compressed air usage on a national basis. It's an established fact and a number that has been proven again and again. "What's more, those figures are based on air systems with good programs in place," said Morgan. "We've seen much larger percentages with leak rates from 30–40% at some facilities."

ENERGY COST OF OPEN BLOWING		
SIZE	AIR FLOW	COST PER YEAR
1/16 inch	6.49 scfm	$ 1,094.00
1/8 inch	26.0 scfm	$ 4,404.00
1/4 inch	104 scfm	$ 17,616.00

Costs are based on $0.10 kW/Hr, 8760 Hrs/Yr. Operation
The air flow shown above is based on 100 psig
The rate of flow increases as the pressure increases

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

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

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  - A. Energy and utility managers share experiences
  - B. Audit case studies and "Best Practice" recommendations
- **Utility Providers & Air Auditors**
  - A. Utility company rebate programs
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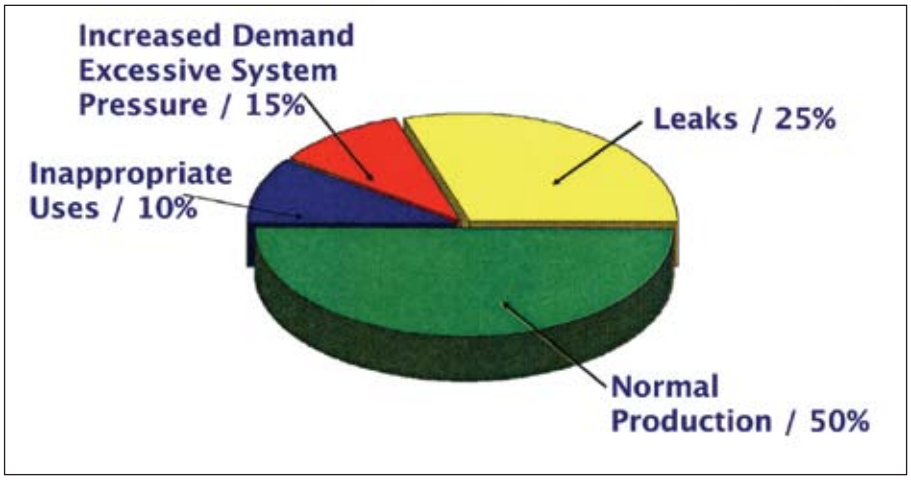


By implementing an air leak program, which includes repairs, facilities can see immediate savings with project returns of 2–5 months, Morgan said. "A moderate size system utilizing a 150 hp compressor can produce, 650 scfm of compressed air. A system of this size with a 25% leak ratio can spend $33,000.00 per year just on air leaks — the equivalent of 43 bhp of the air compressor. We go after that 25% and reduce it to a manageable leak rate (calculations are based on $12 kWh, 8000 hours per year.)"

Advanced Air Leak Detection Services, Inc.
Compressed Air Solutions

Advanced Air Leak Detection Services

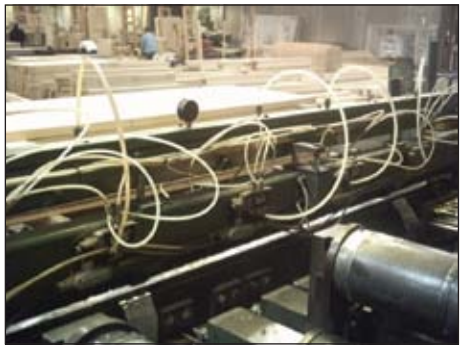
Compressed air leaks will commonly take a backseat in manufacturing environments, according to Jim Morgan, a compressed air industry veteran. He's the owner of a new company called Advanced Air Leak Detection Services (ALD) offering:

- Ultrasonic air leak detection services
- Guaranteed result air system audits
- Audit implementation for guaranteed ROI
- Demand-side optimization solutions like air storage packages, point-of-use blower systems and pressure stabilization

Morgan has worked in a wide range of capacities for more than 25 years in the compressed air industry and Advanced Air Leak Detection Services is his solution to a chronic industry-wide problem. "ALD is a company that is long overdue, because air leaks have always been a neglected component of an air system and yet a repair program offers immediate results and the best ROI. Repairing air leaks is not a priority in many manufacturing facilities because labor costs are focused on producing product and "leaks will return anyway." Many facilities let air leaks go until they have a huge impact on the facility's productivity and quality.

Morgan has seen the ball dropped again and again when plants don't follow through on audit recommendations, even though doing so is clearly a sage investment. "Over the years working with auditors and completing audits at a distributor level, I discovered that many of these

Work With Maintenance to Prioritize the Repair of Leaks



According to Morgan, ALD goes through an extensive step-by-step set of procedures to implement their leak reduction program. First, they analyze the supply station and compressor controls to create an energy base line. Second, they analyze the end users and their pressure requirements. Then, ALD also identifies secondary storage solutions throughout the plant during the walk through. Once identified and tagged a repair program is immediately implemented. This process varies depending on the size of the facility but can normally be accomplished in one week. It's important to begin at the compressor pad data-logging and measuring the key performance indicators of the supply side of the system. "We then spend the majority of the audit learning everything we can about their production system needs, where the large air users are; where stable pressure is critical and where it isn't; if they use poly tubing, quick couplers or if they hard piped to the production equipment."

companies never even implemented the audit recommendation, even if the ROI was inside of one year. The audit reports were too complex and confusing and therefore represented too much risk to implement. So, the facility personnel would either implement portion of the recommendations, purchase items they didn't really need or do nothing at all."

Jim Morgan, the owner of Advanced Air Leak Detection Services, has twenty two years of auditing experience in Northern California.

Morgan formerly owned a large distributorship in northern California for more than two decades, before selling it in 2008. He's performed more than 2,000 air system audits and retrofitted hundreds of those reports for manufacturing facilities ranging from high-tech to food manufacturing, as well as working with several of California's largest refineries. "I owe a great deal to a long time friend who spent years teaching me the auditing side of the business while always doing the right thing from a systemic approach, Mr. Dean Smith from iZ Systems," Morgan said. "Dean is a true master in the compressed air industry and learning from the best in the business has had a huge impact on my success."

Starting ALD is his way of filling a void in the industry while providing value to the industry as a whole, Morgan said. "At ALD, our goal is to give back to the companies that I have worked with for the past 22 years. We can help them save money, simplify their work, and verify an excellent ROI in a relatively short time, normally 2–5 months. We also work with local utility companies to maximize any rebate programs associated with energy reduction projects. Our base is Northern California, but we're also working with several corporate customers on a national level based on specific experience, including can manufacturers, PET bottle blowing companies and refineries."

MAINTENANCE SAVES ENERGY

Advanced Air Leak Detection Services

> "We work with the maintenance department to plan ahead so that the priority repairs can be completed by plant personnel, outside contractors or our ALD mechanics determined by the clients preference — the same day as the leak audit."
>
> — Jim Morgan of ALD

After many years of auditing and doing leak detection, Morgan is adept at knowing where to look. "Approximately 95% of leaks are found inside or around the production equipment. Only 5% are on the headers or the piping systems." In order to find leaks in hard-to-reach places (often inside of production machines), ALD uses ultrasonic leak detection equipment capable of "hearing" the leaks from a distance. Utilizing their experience with the detection equipment, leaks can be prioritized as they are detected saving time and maximizing the value derived from labor costs for repairs.

There has always been a struggle to get leaks repaired. The key is to plan ahead and prioritize the repair of the leaks. ALD identifies the severity of leaks and puts them into three categories:

- Category 1 Leak: Priority Repairs
- Category 2 Leak: Scheduled Repairs
- Category 3 Leak: Lower Priority Repairs

Category 1 Leaks identified as "Priority Repairs" are fixed the same day of the study Morgan said, "We work with the maintenance department to plan ahead so that the priority repairs can be completed by plant personnel, outside contractors or our ALD mechanics determined by the clients preference — the same day as the leak audit." Morgan continued, "We're not concerned with who fixes the leaks — ALD provides the assurance that the job gets completed so the ROI is achieved."

How to "Maintain the Gain"

Scheduled (Category 2) and lower priority repairs (Category 3) are placed into the ALD leak maintenance program. "We will come back two or three times a year to assure the tagged leaks are repaired," says Morgan. "It is not uncommon for tags to be removed before repairs are completed, therefore, we go through our records to match the report with all leak tags so nothing is overlooked or missed.

Refineries experience compressed air leaks ranging in severity from Category 1 to Category 3.

When ALD revisits the facility as part of a maintenance program, they re-assess the supply equipment and system operation while reviewing the baseline. They then locate all tagged leaks, which are still in the system, remove each leak tag, re-measure and retag. They also work with the local utility company to complete the rebate paperwork and do the measurement verification to maximize the rebate money for the client and ROI on the project. BP

For more information please contact Jim Morgan, Advanced Air Leak Detection Services, Tel: 925-953-3839, email: jim@airleakdetection.net, www.airleakdetection.net

THE "DIRTY THIRTY" – DISCOVERING PRESSURE DIFFERENTIAL AT THE FAR END

BY RON MARSHALL FOR THE COMPRESSED AIR CHALLENGE®

Much attention and expense is often directed towards optimizing compressor control, clean-up equipment, system pressure/flow control and main system piping in an attempt to maintain adequate and stable pressure at the end use. Often forgotten are the components of the distribution system between the main system header and the end use.

Fundamentals of Compressed Air Systems WE (web-edition)

Join us for the next session of *Fundamentals of Compressed Air Systems WE* (web-edition) coming February 28th. 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**.

THE "DIRTY THIRTY"

Tom Taranto, an Advanced Level 2 Compressed Air Challenge instructor uses the phrase "The Dirty Thirty" to help his students in Compressed Air Challenge's Fundamentals and Advanced Seminars remember the importance of addressing end use pressure differential. We asked Tom for his insights on this subject:

"It is surprising when the pressure drop at the last dirty thirty is 10 or 20 times the pressure loss in the long pipe all the way back to the compressor room."

— Tom Taranto, an Advanced Level 2 Compressed Air Challenge Instructor

What is the "Dirty Thirty"?

That last bit of compressed air piping connecting the end use pneumatic equipment to the compressed air header is a part of the compressed air system that I fondly refer to as the "last dirty thirty". The reason is that it's typically a distance of about 30 feet and the innovative/creative piping designs and installation methods are truly amazing. That last bit of piping installation is usually done with the pressure to get things running quickly and as a result is made up with the available pipe, hose, tubing, fittings, hose clamps, plastic tubing, shut-off valves, filter/regulator/lubricator (FRL) assemblies, and whatever else it takes to get compressed air connected to the machine. Since components are selected based on what's available, little consideration is given to the average air demand and peak airflow rate used by the equipment. Of course we can't forget about the "add-ons" for a little compressed air to run this or that.

How often have you seen problems at the end use and what is the most common problem?

Excessive restriction to compressed air flow results in equipment being starved for air supply, adversely affecting the equipment's performance. Casual investigation and anecdotal information can lead to the conclusion that "we need higher pressure".

What are people most surprised by?

There is often a 30, 40, 50 psi pressure drop, or more, in the last dirty thirty of compressed air piping. If there is a pressure problem with a piece of equipment, and it is several hundred feet back to the compressor room, it could be reasonable to assume that there must be a significant pressure loss in the long distance. It is surprising when the pressure drop at the last dirty thirty is 10 or 20 times the pressure loss in the long pipe all the way back to the compressor room.

What's a quick way to check for pressure drop problems?

A quick way to check if you have a problem at the far end is to install pressure gauges as close as possible to the end use tool, pneumatic cylinder, air motor, or whatever is the end productive use. The more the pressure gauge drops when the tool uses compressed air, the greater the upstream piping restriction. It's important to know that gauges, being mechanical devices, do not respond very quickly. If the gauge shows a 5 psi dip, the actual pressure decay may be 15 or 20 psi. Consider purchasing a digital pressure gauge with the capability to capture peak and minimum pressure readings.

How do you correctly size hoses, filters, and regulators to avoid pressure drop?

When sizing hoses, connectors, and filters and regulators it is important to evaluate the dynamic use of compressed air and NOT cubic feet per minute (cfm) average air flow rate. For example, a machine is rated to use the average air flow rate of 20 cfm but it operates for 15 seconds and is idle for 45 seconds of every minute. The dynamic air flow rate is 80 cfm rate of flow during the 15 seconds that the equipment is using compressed air. Point of use piping, valves, FRL's and all components that make up the last dirty thirty need to be sized to handle the 80 cfm peak airflow rate, not 20 cfm rate of flow.

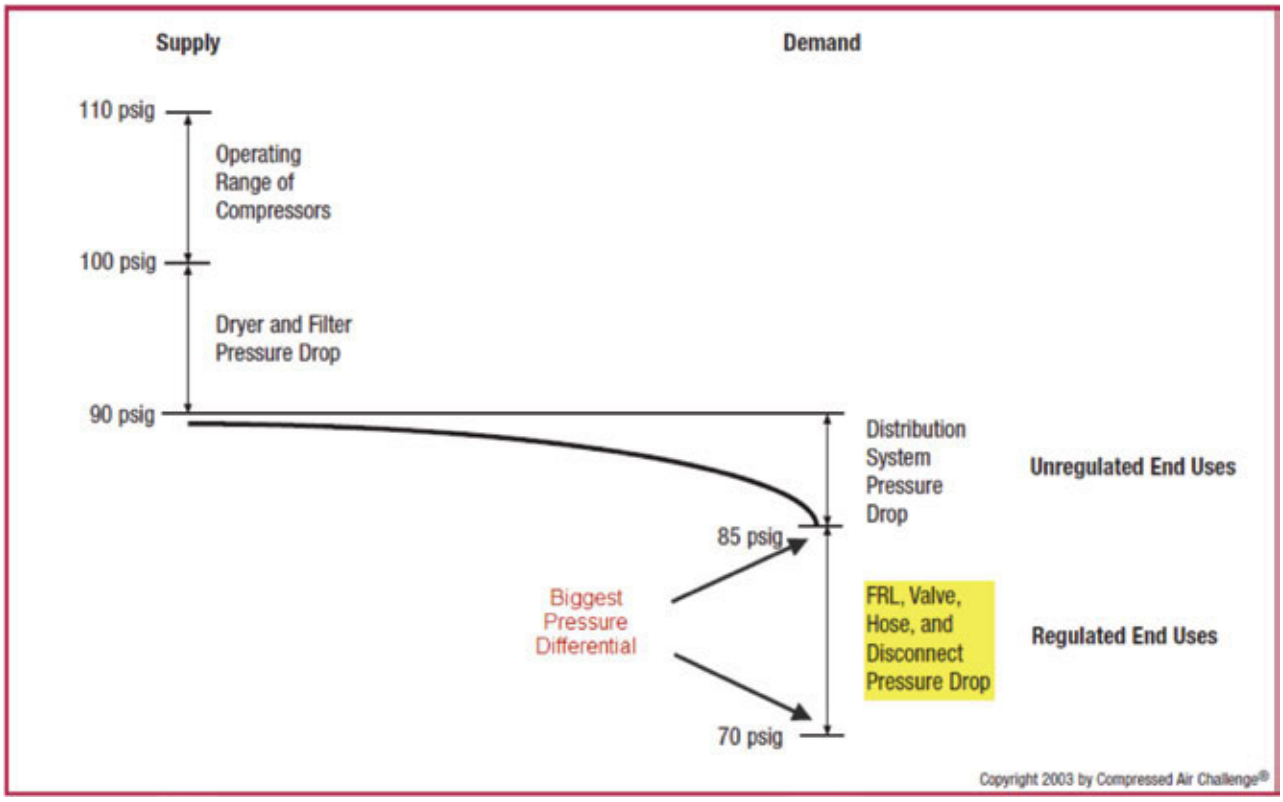


Figure 1: Typical pressure profile showing end use pressure differential

Effects of Pressure Differential

Excessive pressure drop at the end use will force an increase in total system pressure and lead to excessive compressor energy consumption. Minimizing differentials in all parts of the system, including the last "Dirty Thirty" is an important part of efficient operation.

There is also another penalty for higher-than-needed pressure. Raising the compressor discharge pressure increases the demand of every unregulated usage, including leaks, open blowing, etc. Although it varies by plant, unregulated usage is commonly as high as 30 to 50% of air demand.

THE "DIRTY THIRTY"

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For systems in the 100 psig range with 30 to 50% unregulated usage, a 2 psi increase in header pressure will increase energy consumption by about another 0.6 to 1.0% because of the additional unregulated air being consumed. The combined effect results in a total increase in energy consumption of about 1.6 to 2% for every 2 psi increase in discharge pressure for a system in the 100 psig range with 30 to 50% unregulated usage.

Elevating system pressure to compensate for poor design in the last "Dirty Thirty" increases unregulated uses in the whole system, for applications without regulators or with wide open regulators. The added demand at elevated pressure is termed "artificial demand," and substantially increases energy consumption. Instead of increasing the compressor discharge pressure, or adding additional compressor capacity, alternative solutions should be sought, such as reduced pressure drop with optimized component selection. Equipment should be specified and operated at the lowest efficient operating pressure.

In the distribution system, as shown in Figure 1, the highest pressure drops are usually found at the points-of-use, including undersized or leaking hoses, tubes, disconnects, filters, regulators and lubricators (FRLs). The maximum pressure drop from the supply side to the points-of-use will occur when the compressed air flow rate and temperature are highest. System components should be selected based upon these conditions and the manufacturer of each component should be requested to supply pressure drop information under these conditions.

CAC® Qualified Instructor Profile

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KNOW PRESSURE COMPRESSED AIR CHALLENGE®

Tom Taranto is an independent compressed air system professional with more than 30 years of experience providing services to industrial clients, utilities, and energy agencies. He is the owner of Data Power Services, LLC. He has extensive experience in design and application of fluid power systems both hydraulic and pneumatic. Tom's work involves compressed air system design, air compressor application, and performance of related compressed air system components. He conducts compressed air system assessments, equipment testing, and compressed air system training throughout the world. More information about Tom can be found at the CAC website.

A Real Life Example

A printing company had installed a new machine designed to collate pages to help automate the assembly of a coil-bound book line they were publishing for a major customer. Orders were placed on an as-needed basis and could not experience delay.

Installation of the machine was done on a priority basis during a quick weekend production shut-down. Immediately upon on installation of the machine the production of books experienced problems that were diagnosed as low pressure issues. The plant was previously running at a pressure/flow control setting of 100 psi, but now the pressure/flow controller had to be bypassed and the plant pressure turned up to as high as the compressor rating would allow. Even with this, some pressure issues continued on occasion as if at random.

A compressed air auditor was called in to investigate. On examination of the supply system to the machine, it was discovered that a 15 foot section of ¼ rubber hose was being used to feed the machine. During installation, there was not enough time to hard pipe the machine into the main piping drop and since the plant used standard ¼ inch hose, this was used instead. Plant personnel, in their haste, had not realized the consequences of installing this type of supply feed. The following table shows the resulting pressure differential of 15 feet of ¼ inch hose at the collator's peak flow of 20 cfm, which was confirmed by pressure measurement. Pressure differential across two additional quick couplers further reduced the pressure the machine was actually receiving to a level far below what was required for acceptable operation.

Hose I.D. (in.)	Total psi Loss (psi.)	Hose Pressure Drop (psi/ft.)
0.1875	112.7985	7.5199
0.25	24.8600	1.6573
0.375	2.9498	0.1967
0.5	0.6501	0.0433

Table 1: Pressure differential of various sized hoses (15 feet at 20 scfm): Source: www.gates.com

It should be noted that if the next size larger hose of 3/8 inch would have been used, a reduction in pressure differential of about 22 psi or 88% would have resulted.

Various reference documents are available to assist in helping size supply components for end use equipment. One of which is CAC's "Best Practices for Compressed Air Systems" Appendix 3.A.1. This 325-page book is available at our bookstore at www.compressedairchallenge.org. BP

"Elevating system pressure to compensate for poor design in the last 'Dirty Thirty' increases unregulated uses in the whole system, for applications without regulators or with wide open regulators."

— Tom Taranto, an Advanced Level 2 Compressed Air Challenge Instructor

RESOURCES FOR ENERGY ENGINEERS

TRAINING CALENDAR

TITLE	SPONSOR(S)	LOCATION	DATE	INFORMATION
Compressed Air Challenge® Advanced Management of Compressed Air Systems	SoCal Gas California Energy Commission	Downey, CA	2/16/11–2/17/11	Larry Bennett Tel: 562-803-7570 lbennett@semprautilities.com
Compressed Air Challenge® Fundamentals of Compressed Air Systems	Online Training	web-edition	2/28/11	www.compressedairchallenge.org info@compressedairchallenge.org
Compressed Air Challenge® Fundamentals of Compressed Air Systems	Penn State Technical Assistance Program	Strattanville, PA	3/2/11	Shelly Luchini Tel: 814-375-4772 smc200@psu.edu
Compressed Air Challenge® Advanced Management of Compressed Air Systems	KPPC	Louisville, KY	3/22/11–3/23/11	Tel: 502-852-0965 training@kppc.org www.kpc.org
Compressed Air Challenge® Fundamentals of Compressed Air Systems	ProtoGen Group	Kettering, OH	4/15/11	Ray Lepore Tel: 937-216-9452 ray.lepore@fastmail.fm
Compressed Air Challenge® Fundamentals of Compressed Air Systems	Hughes Machinery Atlas Copco Omaha Public Power	Omaha, NE	4/26/11	Dennis Tribbie Tel: 402-571-5004 dtribbie@hughesmachinery.com
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Editor's Note: If you conduct compressed air system training and would like to post it in this area, please email your information to rod@airbestpractices.com.

PRODUCTS

Kaeser Announces New Oil-less Airbox Series

Kaeser introduced a completely oil-free air compressor: the Airbox. This quiet, energy efficient piston compressor is ideal for laboratories, high-tech, clean room or any applications requiring modest air flow. The Airbox is available as a fully enclosed stand-alone compressor, or as an Airbox Center including the compressor, tank, dryer, filters and drain in a single package. Units are easy-to-install, require minimal service and provide 100% duty cycle. Also, these units are very quiet and nearly vibration-free. Airbox units feature Kaeser's Sigma Control Basic allowing for pressure adjustment and system monitoring, and also controls the dryer on Airbox Center models. The Airbox series is available from 4–12 hp, and delivers up to 36.9 cfm at 100 psig.

Kaeser Compressors
Tel: 800-777-7873
www.kaeser.com

PRODUCTS

Hitachi Introduces New Oil-Free Air Compressors

Hitachi America announced it has expanded its product line of Oil-Free Rotary Screw Air Compressors to include units in the size range 132–240 kW. "The expansion of our Larger DSP Series creates unparalleled value for the discriminating air user. Innovations such as life cycle cost reductions, space conservation and increased efficiency make this product a real asset to the manufacturing environment. The expanded portfolio also represents Hitachi's continuing focus on serving both our customers' needs and on our mission to create products that are environmentally-friendly," noted Nitin G. Shanbhag, Senior Manager of the Hitachi Air Technology Group.

Feature highlights of the DSP Series 132–240 kW Product portfolio include:

- Innovative "U-Structure" space saving design (up to 30+% space savings)
- Reduced life cycle costs via elimination of belts and couplings
- HX-18 PTFE free rotor coatings to eliminate performance degradation and produce "Ultimate Air Quality"
- Patented "Power Save" function to reduce energy consumption and to protect compressor from short-cycling
- Patented Hi-Precooler to provide efficient cooling and increased longevity for coolers
- Patented Oil Mist Remover to prevent oil mists from venting into the atmosphere
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Eliminate Moisture Sensor Recalibration Downtime With Michell Service Exchange

Michell Instruments customers can replace in-use moisture sensors with freshly calibrated sensors very cost effectively and with virtually no downtime. When recalibration is due, the customer orders a Service Exchange Sensor. The in-use sensor is replaced quickly and easily with the Service Exchange Sensor and returned for credit. Calibration data is stored within the Service Exchange Sensor module. Reprogramming calibration data into an analyzer electronics is eliminated. All Michell calibrations are traceable to NIST.

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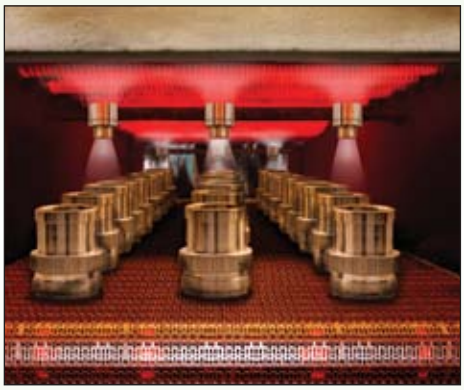
RESOURCES FOR ENERGY ENGINEERS

PRODUCTS

High Temperature Air Amplifier Moves Hot Air



EXAIR's new High Temperature Air Amplifier offers a simple, low cost way to move high volumes of hot air to surfaces requiring uniform heating while in a furnace or oven. There are no impellers or moving parts to wear out. The High Temperature Air Amplifier amplifies airflow up to 18:1 at outlet. The High Temperature Air Amplifier is the most efficient for pushing high volumes of hot air to points that typically remain cool. This special design is rated for environments up to 700 °F (374 °C) and its surface is protected from heat stress by a mil-spec coating process (developed for the aircraft industry), allowing easy disassembly for changing shims or cleaning. Efficiency is high and the sound level is low at only 72 dBA. It is perfect for corrosive applications. Applications include directing hot air to mold cavities for uniform wall thickness of the plastic part, exhausting smoke and fumes, distributing heat in ovens or molds, and sampling flue gases. Construction is type 303 Stainless Steel. Available in 1-1/4" (32mm) diameter only. Prices start at $359.

EXAIR
Tel: 800-903-9247
Email: techelp@exair.com
www.exair.com/htal.htm

Extech Announces New Dataloggers

Extech Instruments announced the new DL150 single-channel and DL160 dual-channel true RMS AC voltage and current dataloggers. The compact new tools are designed for electrical, industrial plant maintenance, and predictive maintenance professionals who need extended recording of in-depth readings for electrical motors, components, or circuits.

The compact true RMS dataloggers measure and log AC voltage to 600V and current to 200A with sampling rates ranging from 1 per second to 1 per 24-hour period and recording capacity of 100,000 (DL150) or 256,000 readings (DL160).

Readings can be easily downloaded via USB to a laptop or PC for analysis, trending, or exporting to Excel format using the dataloggers' software application. The two-line LCD displays time/date, current measurement and min/max values. The loggers can operate in both continuous (overwrite) or stop-when-full recording modes.

The versatile DL150 single-channel datalogger offers users three operating modes: Normal, Peak and Capture. In Capture mode, triggers can be defined to capture in-rush and transients lasting less than 0.25 milliseconds. The Peak button briefly displays peak values while still operating in normal mode.

The two-channel DL160 is useful for simultaneously logging both the current and voltage of one component or one metric from two components. A channel button alternates the display between each channel's values.

The Extech DL150 and DL160 are CAT III-rated. Each comes complete with current clamps, test leads, USB cable, Windows® compatible software, universal AC Adaptor, and 3.6V Lithium battery. Both are available now from stocking distributors with suggested retail prices of $249.99 and $299.99 respectively.

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www.extech.com/instruments

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Sustainable Energy Savings for Compressed Air Best Practices®

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

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

- **Compressed Air Users — Focus Industry**
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  - B. Audit case studies and "Best Practice" recommendations
- **Utility Providers & Air Auditors**
  - A. Utility company rebate programs
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  - A. Profiles of manufacturers and distributors
  - B. Product technologies best suited for the focus industries
  - C. Industry news

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WALL STREET WATCH

BY COMPRESSED AIR BEST PRACTICES®

The intent of this column is to provide industry watchers with publicly held information, on publicly held companies, involved with the sub-industry of compressed air. It is not the intent of the column to provide any opinions or recommendations related to stock valuations. All information gathered in this column was during the trading day of January 25, 2010.

DECEMBER 27, 2010 PRICE PERFORMANCE	SYMBOL	OPEN PRICE	1 MONTH	6 MONTHS	12 MONTHS	DIVIDEND (ANNUAL YIELD) 12 MONTHS
Parker-Hannifin	PH	$86.95	$85.07	$62.92	$58.52	1.33%
Ingersoll Rand	IR	$45.96	$46.79	$38.28	$35.53	0.61%
Gardner Denver	GDI	$70.82	$69.49	$52.70	$41.40	0.28%
Atlas Copco ADR	ATLCY	$21.30	$22.27	$15.30	$12.77	1.83%
United Technologies	UTX	$81.21	$79.37	$71.96	$69.51	2.09%
Donaldson	DCI	$59.04	$58.74	$47.77	$40.59	0.88%
SPX Corp	SPW	$76.93	$70.63	$60.19	$57.40	1.30%

Donaldson Company, Inc. (NYSE: DCI) announced its financial results for its fiscal 2011 first quarter. Summarized financial results are as follows (dollars in millions, except per share data):

THREE MONTHS ENDED OCTOBER 31, 2010			
	2010	2009	CHANGE
NET SALES	$537	$428	25%
OPERATING INCOME	$75	$52	42%
NET EARNINGS	$53	$35	54%
DILUTED EPS	$0.68	$0.44	55%

"I am very pleased with our first quarter performance which delivered an all-time EPS record of $0.68," said Bill Cook, Chairman, President and CEO. "Our sales were up 25% from last year and also grew 4% sequentially from the previous quarter. Our sales growth, combined with our operating margin of 13.9%, generated a 42% increase in operating income and a 55% increase in EPS. Our sales have now improved sequentially in each of the past six quarters."

"Sales in our Engine Products' segment increased 33% over the prior year as new equipment build rates accelerated at our OEM Customers. Our Aftermarket Products' sales remained at record levels due to our continued market share gains and better equipment utilization rates in the field."

"Within our Industrial Products' segment, sales increased 15% due to the continued improvement of dust collection sales within Industrial Filtration Solutions Products and continued strong sales within Special Applications."

"Sales improved in all of our regions as local currency sales increased 32% in the Americas, 29% in Europe, and 16% in Asia." "We expect a continued strengthening of our business conditions and some benefit from the weaker US$ resulting in our new projection of full year revenues of approximately $2.2 billion. With a projected record operating margin performance of between 12.8 and 13.8%, we now forecast our full year EPS to be a new record between $2.54 and $2.74."

Financial Statement Discussion

The impact of foreign currency translation decreased sales by $3.7 million, or 0.9% compared to the same period last year. The impact of foreign currency translation on net earnings was not material.

Gross margin was 35.0%, compared to 34.7% in last year's first quarter. The increase in this year's first quarter gross margin was the result of improved fixed cost absorption and our ongoing Continuous Improvement initiatives, partially offset by increases in our purchased raw material costs and a less favorable sales mix. In addition, last year's first quarter gross margin included restructuring charges of $0.8 million.

Operating expenses for the quarter were $113.6 million, up 18.4% from $96.0 million last year. As a percent of sales, operating expenses decreased to 21.2% from 22.4% last year. Included in the current quarter's operating expenses were restructuring charges of $0.7 million. Last year's first quarter operating expenses included $0.5 million of restructuring charges.

The effective tax rate for the quarter was 26.2%, compared to a prior year rate of 30.9%. The decrease was primarily due to favorable settlements of foreign tax audits.

As part of our ongoing share repurchase program, we repurchased 150,000 shares, or 0.2% of our outstanding shares, for $6.5 million.

"Our sales growth, combined with our operating margin of 13.9%, generated a 42% increase in operating income and a 55% increase in EPS."

— Bill Cook, Chairman, President and CEO of the Donaldson Company

WALL STREET WATCH

"Sales improved in all of our regions as local currency sales increased 32% in the Americas, 29% in Europe, and 16% in Asia."

— Bill Cook, Chairman, President and CEO of the Donaldson Company

FY11 Outlook

We expect a continued recovery in many of our end markets in FY11, with higher growth rates in the emerging economies.

- We are planning our total FY11 sales to be approximately $2.2 billion. For the full year FY11 versus FY10, we now expect foreign currency translation to increase sales by 2% based on the Euro at US$1.38 and 82 Yen to the US$
- Our full year operating margin is forecasted to be 12.8 to 13.8%. Our annual stock option expense is estimated to be between $7.5 and $8.5 million, with 70% of that incurred in the second quarter
- Our full year FY11 tax rate is projected to be between 27 and 30%
- Our full year FY11 EPS is expected to be between $2.54 and $2.74
- Cash generated by operating activities is projected to be between $250 and $280 million in FY11. Capital spending is estimated to be between $70 and $80 million

Engine Products:

We expect full year sales to increase 19 to 24%, including the impact of foreign currency translation.

- We anticipate sales to our construction, agricultural, and mining equipment OEM Customers to remain strong as their production rates continue to increase
- We are forecasting lower sales for our Aerospace and Defense Products due to the decreases in U.S. government spending for major programs
- In our On-Road Products' business, we believe that build rates for heavy- and medium-duty trucks at our OEM Customers will continue improving
- Sales of our Aftermarket Products are expected to remain strong based on current utilization rates for both heavy trucks and off-road equipment. We also expect to continue benefitting as our distribution networks expand in emerging economies and from the increasing number of systems installed in the field with PowerCore® and our other proprietary filtration systems

Industrial Products:

We forecast full year FY11 sales to increase 10 to 15%, including the impact of foreign currency translation.

- Our Industrial Filtration Solutions' sales are projected to increase 13 to 18% as the demand for new filtration equipment continues to improve as general industrial capital spending increases
- We anticipate our Gas Turbine Products' sales to be up approximately 5% due to strength in the oil and gas markets
- Special Applications Products' sales are forecasted to increase 9 to 14% as the end markets for our various specialty filtration products are expected to continue growing BP

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THE MARKETPLACE

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PENNSYLVANIA CONVENTION CENTER

For 2011, the ***Association of Energy Engineers (AEE)*** has teamed up the host, PGW, along with a powerful cross-section of cosponsors to present this industry conference and expo which addresses innovative energy management programs, distributed generation strategies, HVAC and building systems success stories, green buildings, the role of renewables, energy procurement updates, power quality solutions, and more. The conference and expo is held on March 30-31, 2011 at the PA Convention Center located in Philadelphia, PA.

GLOBALCON 2011 offers more training flexibility than ever before with a multi-track conference program, intensive seminars, and an energy, power, and facility management expo. Visit the **GLOBALCON 2011** exposition and discover the latest strategies to reduce costs, upgrade equipment, and improve operational efficiency. Access to this valuable expo is included with full conference registration. The expo offers the chance to network with various equipment and service providers. We have also added a series of FREE exhibit hall workshops to help get you up to speed on the latest technologies and success stories. For full details on any of the events during the **GLOBALCON** conference and expo, visit the show website for full details on all the programs: www.globalconevent.com.

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GLOBALCON'S Northeast Green showcase, co-presented by the U.S. EPA's ENERGY STAR®, will also be a prominent part of the event for 2011. Here you can examine firsthand the latest green / sustainable / environmentally friendly energy technologies now available for both new design and retrofit projects. Conference presentations will facilitate your understanding of these technologies, covering such topics as green building design and retrofit; LEED certification and building commissioning; high performance facilities; the latest developments in renewable energy; reducing carbon emissions; transportation solutions for the future; and green/sustainable project success stories.

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