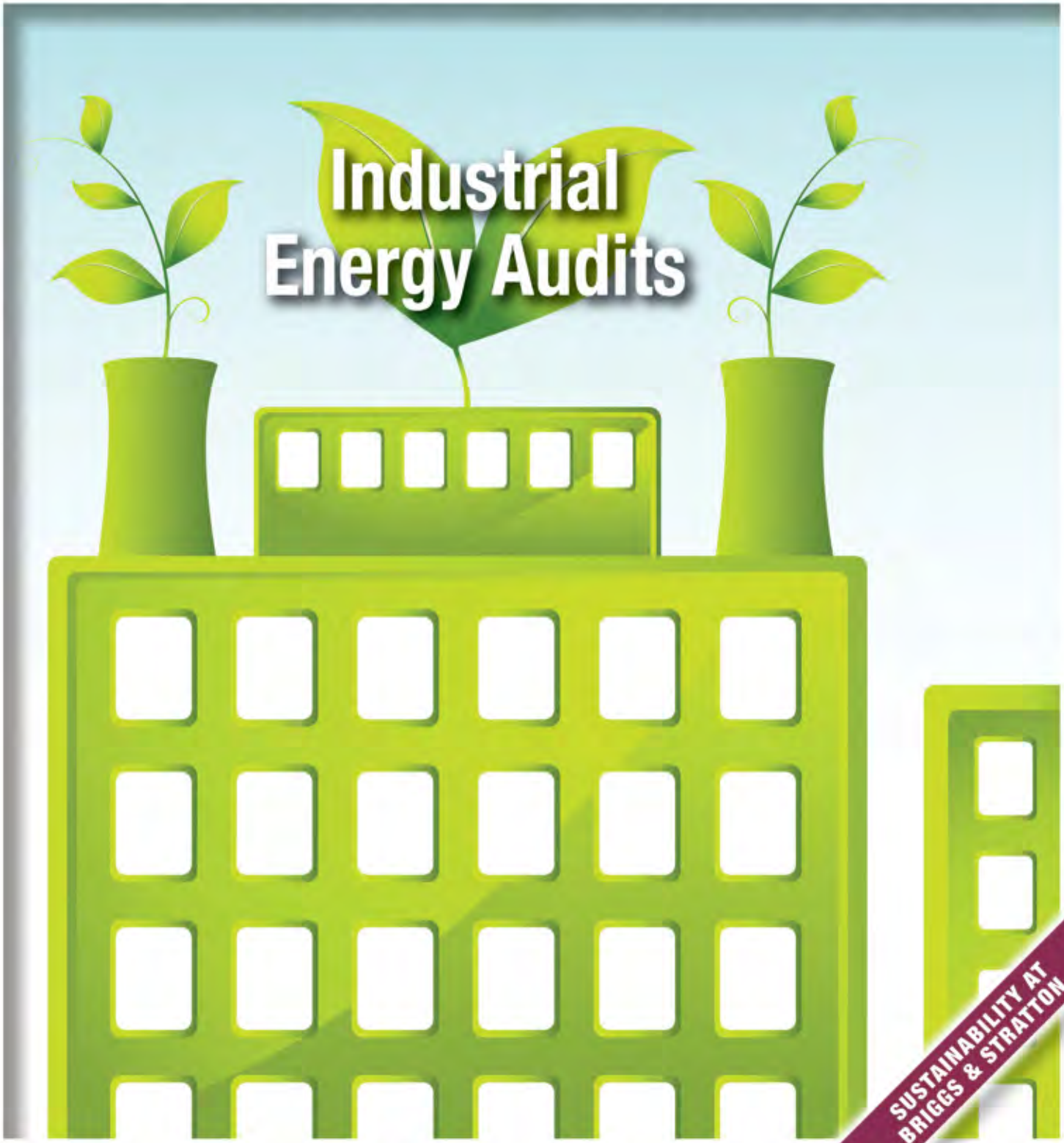
Steam Trap Surveys | Measuring & Monitoring | Compressed Air Leaks: Fact vs. Myth

November/December 2009

COMPRESSED AIR

BEST PRACTICES®



Industrial Energy Audits

SUSTAINABILITY AT BRIGGS & STRATTON

Atlas Copco Carbon Zero Compressors

Sending your energy costs into free-fall

Atlas Copco turns your demands into sustainable solutions

With over 30 local offices and a network of appointed distributors across the US, Atlas Copco's compressed air experts are always available right where you do business!

Atlas Copco is very proud to have been named as one of the top 100 sustainable companies in the world for 4 years running.

Call today and start SAVING!

CARBON ZERO

The "Carbon Zero" compressor !
100% of the energy is recoverable*

866-688-9611

www.carbonzerocompressors.com

We are committed to your superior productivity through interaction and innovation.

Atlas Copco

*100% energy recovery is only possible under certain conditions

HITACHI
Inspire the Next

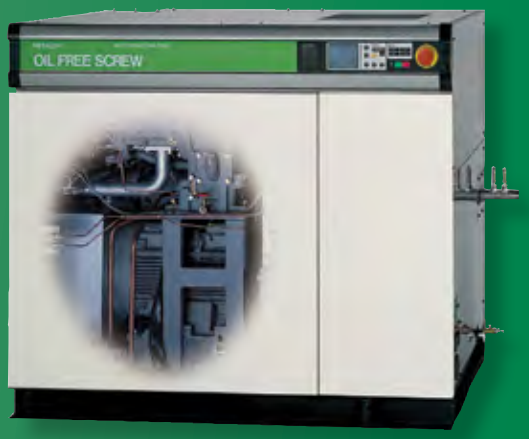
DSP Series Oil-Free Air Compressors

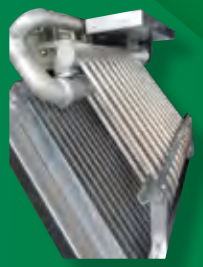
(15-240 kw/20-300 hp)

Class Zero

No Inlet Valve Design
(Patented)

Stainless Rotors with
PTFE-Free Coatings
(Patented)





Hi-Precooler
(Patented)

Oil Mist Remover
(Patented)

Hitachi MFG High
Efficiency Motor
and Inverter

Motorized Isolation Valve
(Exclusive)

"Hitachi DSP Oil-Free Compressors are designed with market leading technologies for increased customer satisfaction. Innovations of Compression, Air Quality, Protection of Process, Longevity of Design, and Efficiency of Application all combine to provide an unparalleled sum of value for the discriminating air user."

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

HITACHI
Inspire the Next

SUSTAINABLE MANUFACTURING FEATURES

The System Assessment of the Month: | 12
Compressed Air Leaks: Fact vs. Myth
By Hank Van Ormer, Air Power USA

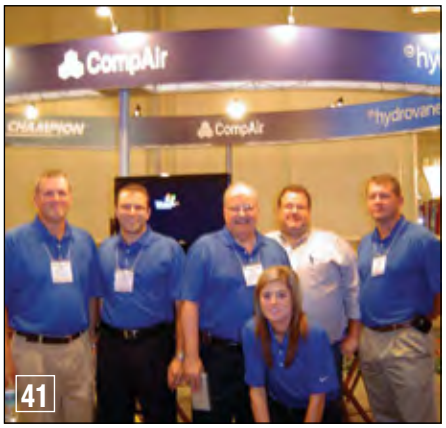
The Energy Manager: | 16
Sustainability Motors On at Briggs & Stratton
By Rod Smith, Compressed Air Best Practices®

The Technology Provider: | 20
Food Industry Expertise at Parker domnick hunter
By Compressed Air Best Practices®

The System Assessment: | 25
Why Do Steam Traps Fail?
By Bruce Gorelick, Enercheck Systems and Alan Bandes, UE Systems, Inc.

Seven Sustainability Projects for Industrial Energy Savings: | 29
Project Implementation
By Thomas Mort, CEM, Saving With Energy

It Pays to Give Energy Management a Thought! | 32
Part 1: Accurate Measurements and
Part 2: Monitoring and Managing Compressed Air
By Jason Pennington, Madhukar Puniani and Stefan Woehrle, Endress+Hauser



COLUMNS

From the Editor | 6

Sustainable Manufacturing News: | 7
Atlas Copco, United Technologies Corporation, Ingersoll Rand, AMCOR

The North American Association of Compressor Distributors (NAACD) Annual Meeting | 41

Resources for Energy Engineers: | 43
Training Calendar, Industry News and Product & Literature Picks

Wall Street Watch | 47

Advertiser Index | 49

The Marketplace | 50

Think Hankison...

for your energy saving solutions!

Introducing Hankison's New Energy Saving Refrigerated Air Dryers!

Hankison compressed air treatment products have set the standard for premium performance, time proven reliability and optimal energy savings. After 60 years, we continue to develop innovative technologies to best serve our valued customers. Choose Hankison...New Products...New Ideas...Still the Best!

HANKISON

TEL: 724 | 745 | 1555
Email: hankison.inquiry@spx.com
www.hankisonintl.com/ES

SPX

FROM THE EDITOR

Industrial Energy Audits

Maintaining the integrity of industrial energy audits is a topic that system assessment professionals take very seriously. They will offer guaranteed returns-on-investment (ROIs) and/or take great care to help the customer understand the "before and after" results on their energy bill. As "auditing" becomes more and more popular, corporate energy managers must be able to choose the auditors and projects that deliver the most reliable and profitable ROIs.

Compressed air leak audits have been heavily publicized (and rightfully so) as a "quick-win" in reducing the energy costs of compressed air systems. The DOE estimates that every factory, on average, leaks 25% of their compressed air to ambient. Why is it then, that some factories don't see the "quick-win" financial results after a leak audit? Mr. Hank Van Ormer has successfully performed thousands of profitable leak audits over the years for his customers. In his "Myth vs. Fiction" article on leak audits, Mr. Van Ormer details some issues that energy managers should be aware of when contracting a leak audit.

Briggs & Stratton has a long and storied history in the United States. They are also taking a leadership role in promoting sustainability initiatives. Mr. Richard Feustel, the corporate energy manager at Briggs & Stratton, is leading a strong energy management program at the company. In our interview with him this month, Mr. Feustel discusses how they started the program, and how they have been able to engage all employees in driving its success moving forward.

Parker domnick hunter has a long history of truly understanding the end user's requirements for high-quality compressed air. With their complete range of compressed air treatment products and nitrogen generators, the company has also focused on the food industry for many years. In this edition, we interview General Manager Nick Herrig and members of his team for insights into food industry air quality requirements.

Our corporate energy manager subscribers continue to drive our content. For this reason, we are providing articles on a variety of energy management topics. In this edition, we offer articles on steam trap assessments, tips on energy-project implementation and funding and, finally, advice on the measurement and monitoring of compressed air systems.

Briggs & Stratton has successfully engaged all employees with their energy management initiative.

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

ROD SMITH
Editor
rod@airbestpractices.com

SUSTAINABLE MANUFACTURING NEWS

Atlas Copco, United Technologies Corporation, Ingersoll Rand, AMCOR

SOURCED FROM THE WEB

Atlas Copco's Sustainability

Since 2001, Atlas Copco's sustainability report has been prepared in accordance with the Global Reporting Initiative (GRI) guidelines. Since 2006, the report has followed the GRI 3.0 version guidelines.

About Atlas Copco's Sustainability Report

Atlas Copco's sustainability report covers all of Atlas Copco's operations for the 2008 fiscal year, unless otherwise stated. Operations divested during the year are excluded, while units that have been acquired are included (see annual report for details). Atlas Copco's most recent sustainability report and corporate governance report were published in March 2009 as part of the 2008 annual report. The 2008 sustainability report is GRI self-declared Level A. Atlas Copco had the self-declared GRI Application Level A confirmed by the audit company KPMG AB. The 2007 sustainability report was self-declared Level B, and was also confirmed by KPMG.

Use of Resources

In 2008, the energy consumption in production increased by 2% in relation to cost of sales. For comparable units, the result was a decrease of 6%. There are several initiatives ongoing within the group to reduce the use of resources, a few of which are presented in the sustainability report.

Emissions and Waste

Standardized conversion factors published by the Greenhouse Gas Protocol Initiative are used to calculate CO_2 emissions (see **www.ghgprotocol.org**). The 3% CO_2 emissions increase in relation to cost of sales from energy at production sites in 2008 was related to the higher energy consumption. For comparable units, there was a decrease of 10% in relation to cost of sales. The 5% decrease in CO_2 emissions in relation to cost of sales in transport during the year was partly explained by a decrease in the use of airfreight as compared to 2007.

SUSTAINABLE MANUFACTURING NEWS

Atlas Copco, United Technologies Corporation, Ingersoll Rand, AMCOR

By reducing energy and associated greenhouse gases, Ingersoll Rand is becoming a greener, and more sustainable, company.

United Technologies

United Technologies Corporation

Since 1992, UTC has continuously reported environment, health & safety (EH&S) performance data. In 1997, we committed to 10-year goals to reduce energy and water use, which resulted in a 19% reduction in energy use and a 49% reduction in water use by the end of 2006. With 2006 as our baseline, we then set even more aggressive goals for improved performance by the end of 2010. These goals include reducing annual greenhouse gas emissions by 3% and water consumption by 2.5%. Since the beginning of 2007, we have achieved 11% reductions on both metrics. UTC environmental reporting standards encourage the ongoing analysis and correction of data as applicable following the close of a reporting period.

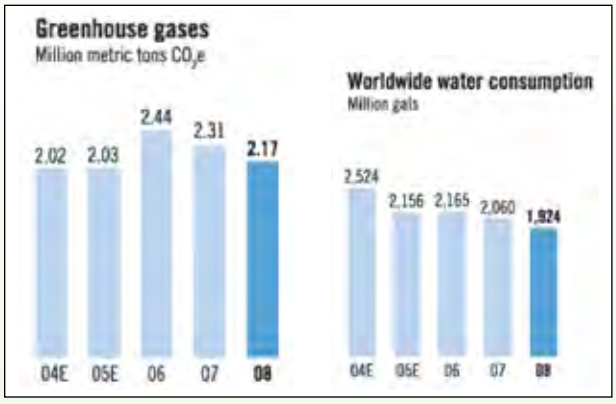
UTC strives to maintain the highest environmental standards everywhere we do business. Environmental sustainability is an important part of both our operations and our products as they perform in service. We have a history of setting aggressive environmental goals and pursuing them by continuously improving our processes at every level of the company. In addition to our own work and to overcome some of today's greatest challenges, we partner with other companies and non-governmental organizations to find and implement solutions.

2009 Environmental Objectives

- Reduce annual greenhouse gas emissions by 3% and water consumption by 2.5% from 2007 through 2010
- From 2007–2010, invest $100 million in energy conservation projects, including co-generation systems
- Ensure compliance with environmental permits
- Develop sustainability goals for the years 2011–2015, with a focus on suppliers and products in use

2008 Environmental Performance

Key Performance Indicators



Background

Beginning in 1991, UTC established environment, health & safety (EH&S) goals, and the following year began publicly reporting performance against them. In 1997, after meeting and exceeding many goals ahead of schedule, UTC committed to aggressive 10-year goals to reduce energy and water use. We added air emissions and waste reduction goals in 1999.

After achieving all of the environmental metrics set in the previous goals, we then established even more ambitious goals for improved performance between January 1, 2007 and December 31, 2010 (using 2006 results as our baseline). We have committed to reducing greenhouse gas emissions by 12% and water consumption by 10% through the end of 2010. We already exceeded our water reduction goal as of December 31, 2008, and we will continue to aggressively identify and implement further reductions. To measure greenhouse gas (GHG) emissions, we will use the Greenhouse Gas Protocol established by the World Business Council for Sustainable Development and the World Resources Institute.

SUSTAINABLE MANUFACTURING NEWS

Atlas Copco, United Technologies Corporation, Ingersoll Rand, AMCOR

Ingersoll Rand

Environmental Performance

For the first time, Ingersoll Rand is able to report environmental performance metrics from its operations worldwide. This report includes performance metrics and other information for the following topics:

- Material and water use
- Energy use
- Greenhouse gas emissions
- Waste and recycling
- Product stewardship and supplier management
- Compliance

Water Use

The amount of water used by Ingersoll Rand facilities includes the total amount of water used for processes, cooling, maintenance, landscaping, sanitary needs and other activities. This does not include water in closed loop systems, other than water added during the year. Ingersoll Rand facilities used 6,863 million liters (1,813 million gallons) of water in 2008.

Water Conservation Projects Drive Savings

Our security technologies facility in Princeton, Illinois, has reduced its water usage by nearly 40% from 2007 to 2008. This reduction is the result of several improvements to the facility's 5-stage washer, the completion of its conveyor project and various improvements identified during an energy and environmental "treasure hunt" held in 2008.

Energy Use

Energy conservation has become an increasingly important sustainability issue, from the impact of energy use on greenhouse gas emissions to the high costs of energy in today's markets. Ingersoll Rand is working to reduce energy consumption at our operations. Energy efficiency is a top priority for our facility operations, as well as in our product development strategy.

The energy-saving actions implemented around our global operations include energy and compressed air audits involving facility staff and Trane professionals, installing timers on the power switches for building ventilation systems, promoting equipment maintenance procedures that improve efficiency, requiring staff to switch off all electrical equipment not in use and delivering additional employee training and information on energy-saving procedures. By reducing energy and associated greenhouse gases, Ingersoll Rand is becoming a greener, and more sustainable, company.

Ingersoll Rand facilities report energy use internally using the IREHS system on a monthly basis. In 2008, Ingersoll Rand used 5,352 thousand gigajoules (1,486 million kilowatt hours) of energy.

AMCOR PET Packaging

At Amcor's PET Packaging business, product design plays a key role, and preserving the planet and sustaining business growth work hand-in-hand.

Lightweighting

During the last fiscal year, lighter-weight PET containers from Amcor reduced resin consumption by 10 million pounds. Here are some examples:

- Big Mouth™, a new PET jar for hot filled foods, is 86% lighter than glass and 34% lighter than traditional heat-set PET.
- The new Amcor Active Hinge™ reduces container weight as much as 20% in this family of 8-, 10-, 12- and 16-ounce bottles.

Post Consumer Recycled (PCR) Material

PET is the most easily and widely recycled plastic material in the world. Post consumer PET material is commonly used in the manufacturing of fabric, carpeting and strapping, and is also used in PET containers.

Amcor consumes 30–40 million pounds of food-grade post consumer recycled (PCR) material annually, and soon will nearly double that amount.

Amcor commercialized the first 100% PCR household cleaning product packaging in the United States. This conversion for virgin PET to PCR reduced carbon dioxide (CO_2) emissions by 60%.

Reducing Our Carbon Footprint

- Amcor PET is on track to reduce facility greenhouse gas (GHG) emissions by 10% by 2001, with a 60% reduction goal by 2030.
- Amcor PET reduced electricity consumption in our North American facilities by over 5% in 2008.

Goals

To help drive continued improvement in our EHS performance, we recently adopted five-year company-wide goals. By measuring and publicly reporting our progress against these goals, Ingersoll Rand will be demonstrating our commitment to world-class EHS performance. Our goals clearly communicate to our employees, customers, suppliers, regulators and neighbors that EHS is an important part of our company culture and business strategy.

Our goals cover the EHS areas where we are committed to drive continuous improvement in our company. Specifically, by 2013 we plan to achieve the following global performance improvements:

- Reduce our recordable incident rate by 67%
- Reduce our lost time incident rate by 67%
- Reduce our rate of energy use by 15%
- Reduce our rate of greenhouse gas emissions by 15%

Progress is greener with Ingersoll Rand

AMCOR

- The Amcor PET "Smash the Trash" programs have cut in-plant waste by 40%.
- Amcor PET has joined the SmartWay Transport Partnership, an innovative collaboration between the U.S. Environmental Protection Agency (EPA) and the freight industry, designed to increase energy efficiency while significantly reducing GHG and air pollution.
- Site-specific water management plans have been implemented to ensure responsible and efficient use of water resources.

THE SYSTEM ASSESSMENT OF THE MONTH

Compressed Air Leaks: Fact vs. Myth

BY HANK VAN ORMER, AIR POWER USA

Accountability with Leak Values

Compressed air leaks — every system has them. But, is a leak identification and control program economically rewarding and/or necessary? Upper management sometimes doesn't recognize the true cost of **not** repairing air leaks. Knowing the high cost of compressed air, why wouldn't every facility with a compressed air piping system implement a continuous leak identification and repair program?

The question remains: why does upper management sometimes fail to recognize the true cost of **not** repairing air leaks? This often happens because accurate values of compressed air leaks (as true air) use reductions, and so the accurate translation into lower energy costs create scenarios which, over the years, lack accountability. Often, we do see a reduction in compressed air use, but there is little if any measured or perceived reduction in the actual electric bill. It is no small wonder that a financial officer might be skeptical of projected savings.

Beware the "cfm to Dollars" Estimate

When a technician is finding and tagging compressed air leaks, he is also creating a "leak-list" and trying to estimate its value in cubic feet per minute (cfm) lost. Figure One reflects the amount of air that will blow through an orifice of a specific diameter at a specific backpressure. The most often quoted number is "…a quarter inch leak will pass 104 cfm at 100 psig," which at $100/per cfm results in $10,000/year in energy cost to produce.

FIGURE 1: PERFECT-WORLD LEAK FLOW

cfm	1/64"	1/32"	1/16"	1/8"	1/4"	3/8"
70 psi	.300	1.20	4.79	19.2	76.7	1.73
80 psi	.335	1.34	5.36	21.4	85.7	193
90 psi	.370	1.48	5.92	23.8	94.8	213
100 psi	.406	1.62	6.49	26.0	104	234
125 psi	.494	1.98	7.90	31.6	126	284

This chart is true, but what is not said is that it is a test orifice of a given design and thickness with a specific "chamfer" to allow for free flow to a wide-open ambient. These statements are often used "for effect," but should not be used to try and estimate the volume. Clearly, none of these leaks are actually through machined, round holes. In fact, many leaks follow a relatively long, tortuous path from the compressed air source to the ambient. As they travel this "restriction path," the backpressure falls and lowers the volume of the leak. But, it is still expensive.

MYTH: Leaks don't really amount to much.

FACT: In most plants, leaks are the single largest user of compressed air. Plants with no effective compressed air leak management program lose up to 30%–50% of their compressed air to leaks.

MYTH: The system may be leaking some air, but it doesn't cost much.

FACT: An air system with 300 horsepower of compressed air in use has approximately 100 hp in probable leaks. At a cost of $.05/kWh electric rate, this is over $35,000 per year of wasted electrical energy, or one-third of the power/energy used to produce compressed air.

Formula: 100 hp x .746 x .05/kWh x 8,760 hrs ÷ .93 ME

In short, when someone says this volume of leaks (cfm) translates into a "savings" of $40,000 per month, what they are really saying is: "It costs you (the plant) $40,000 per month in electrical energy use to produce, dry and distribute this volume (cfm) of air at this pressure (psig) — which is the air lost in these leaks."

Repairing all of these compressed air leaks will not reduce the electric bill by the full cost, unless the amount removed resulted in the complete removal of one air compressor that was at full load and now is no longer needed.

The actual amount of "recoverable electrical energy" is a function of the type of air compressor and the local capacity controls. This recoverable energy cost can vary from 0% to 95% or more.

This is by far the most complicated part of the process for an inexperienced compressed air consultant or auditor not fully trained in all types of compressors and their available capacity control. The capacity control or unloading control is the key element to convert lower air usage by volume into a predictable lower level input power or energy. A well-designed central air management control system can often increase this recovery process and/or stabilize the operation and then "flag" when maintenance attention is required.

The actual amount of "recoverable electrical energy" is a function of the type of compressor and the local capacity controls. This recoverable energy cost can vary from 0% to up to 95% or more.

For example, with a system using full blow-off controls, such as centrifugals or some oil-free rotary screws, the excess air produced is "blown" and the load on the primary compressor stays constant. Lowering the demand may just increase the blow-off — the energy bill will remain the same.

On the other hand, a system where the "trim compressed air supply" is anchored by well-applied, multi-step, variable displacement, variable speed or inlet guide vanes on the proper compressor in the proper load range can translate this lower volume of compressed air usage in almost a commensurate percentage of lower input energy.

This becomes quite complicated for the uninformed, particularly when there are multiple units.

What does compressed air cost?

Energy Cost =

Input hp x .746 x Hrs x Electric Rate/ Motor Efficiency

1 cfm = $100/Year Energy Cost

(100 psig, 4.0 cfm/input hp, .06 kWh, 8,000 hours/yr)

THE SYSTEM ASSESSMENT OF THE MONTH

Compressed Air Leaks: Fact vs. Myth

Consider the following data. Table 1 reflects the variance in plant load performance of a representative single-stage, lubricant-cooled, rotary screw compressor with the four most common, commercial capacity control systems available.

TABLE 1. KEY AIR SYSTEM CHARACTERISTICS — CURRENT SYSTEM*

TYPE CAPACITY CONTROL	2-STEP 40-SECOND BLOW DOWN	THROTTLED INLET 40-SECOND BLOW DOWN	VARIABLE SPEED 40-SECOND BLOW DOWN	VARIABLE DISPLACEMENT 40-SECOND BLOW DOWN
Total Air Available (acfm)	1,000 (3 gal/cfm effective storage)	1,000	1,000	1,000
Average System Flow (acfm) at 85% Load	850	850	850	850
Average Compressor Disch Press (psig)	100	100	100	100
Average System Pressure (psig)	95	95	95	95
Input Electric Power (kW)	170.7	168.9	154.9	154.9
Operating Hours of Air System (hrs/yr)	8,760	8,760	8,760	8,760
Specific Power (acfm/kW)	4.98	5.03	5.49	5.49
Electric Cost for Air/Unit of Flow ($acfm/yr)	$175.92	$174.06	$159.63	$159.63
Electric Cost for Air/Unit of Pressure ($/psig/yr)	$747.66	$739.78	$678.46	$678.46
Annual Electric Cost for Compressed Air ($/yr)	$149,533.00	$147,956.00	$135,692.00	$135,692.00

**Based upon on a blended electric rate of $0.10 per kWh and 8,760 hours/year.*
Basic unit: 200 hp class/1,000 acfm at 220 bhp at 100 psig or (220 x .746 x .93 ME) = 176 kW input.

TABLE 2. COMPRESSOR USE PROFILE — CURRENT SYSTEM

UNIT #	COMPRESSOR: MANUFACTURER/MODEL	FULL LOAD		ACTUAL ELEC. DEMAND		ACTUAL AIR FLOW	
		DEMAND (kW)	AIR FLOW (ACFM)	% OF FULL kW	ACTUAL kW	% OF FULL FLOW	ACTUAL acfm
1	200 hp, single-stage, rotary screw, lubricated, 2-step control	176	1,000	76%	133.8	50%	500
2	200 hp, single-stage, rotary screw, lubricated, modulation control	176	1,000	80%	140.8	50%	500
3	200 hp single-stage, rotary screw, lubricated, variable speed drive	176	1,000	51%	89.8	50%	500
4	200 hp single-stage, rotary screw lubricated, variable displacement	176	1,000	69%	119	50%	500

NOTE: Performance data extrapolated from the DOE/CAC published capacity control performance curves with average lubricant-cooled, rotary screw compressor and 40-second blow down.

The actual amount of "recoverable electrical energy" is a function of the type of compressor and the local capacity controls. This recoverable energy cost can vary from 0% to 95% or more.

This article observes one type of compressor against five to six other types commonly used for this size industrial air supply:

Analyzing the relative results of four different types of capacity control systems on this class unit:

- At 85% flow, the overall specific power only varies by somewhat less than 10% from the highest to the lowest
- Move the demand to 50%, and this variance is now almost 37%
- 85% demand is somewhat more efficient than the 2-step unit with 3-gallon/cfm effective storage, and the variable speed drive and variable displacement controls are almost 10% more efficient
- At 50% demand, the 2-step control unit is 4% more efficient than modulation (6.2 kW). The variable speed drive is 37% more efficient than the modulation and over 25% more efficient than the variable displacement unit
- There are other units and other capacity controls. Capacity controls performance can be significantly reduced by poor piping practice, lack of effective storage, etc.
- The real cost is how many hours the compressor operates at each condition

Summary

This article is not an attempt to fully discuss air compressor capacity controls, but it is this widely varying performance that affects one's ability to successfully predict the input energy (kWh) reduction created by the repair of a certain quantity (cfm) of leaks.

Generally, if you calculate what energy is used to produce the air that leaks, you will not be able to recover all of this energy at part load performance unless you shut off a complete unit in some cases.

This is a relatively complicated process and should be implemented by knowledgeable personnel familiar with all the basic operating characteristics and of the dynamics of the particular system as installed and operating. Any projected improvements in these operating parameters must be factored in.

Once correctly set up, a very accurate acfm/year dollar value can be assigned to each leak repaired that will predict a dollar recovery value for each acfm saved.

The reports to upper management will then reflect predictable returns that will match expectations, and therefore support will be more likely.

Now you have myth vs. fact on compressed air leaks. BP

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

THE ENERGY MANAGER

Sustainability Motors On at Briggs & Stratton

BY ROD SMITH, COMPRESSED AIR BEST PRACTICES®

Briggs & Stratton Corporate Energy Manager, Richard Feustel

Compressed Air Best Practices® Interviewed Richard Feustel, Corporate Energy Manager of Briggs & Stratton.

Good afternoon! Please describe Briggs & Stratton briefly for us.

Good afternoon. Briggs & Stratton is the world's largest producer of air-cooled gasoline engines for outdoor power equipment. Headquartered in Milwaukee, Wisconsin, the company designs, manufactures, markets and services these products for original equipment manufacturers (OEMs) worldwide.

Our roots date back to 1908, when inventor Stephen F. Briggs entered into an informal partnership with investor Harold M. Stratton. This partnership eventually developed into Briggs & Stratton, as it is known today. We are proud to say that we have been custodians of our environment for all these years.

Today we operate nine manufacturing facilities in North America and three outside the United States.

Please describe your emphasis on employee Energy Awareness.

Briggs & Stratton has made the commitment to energy management from top-to-bottom. We have designated a corporate energy manager, established facility energy leaders and created a sustainability team.

We now have energy teams at each facility. They work with a facility energy leader, who usually comes from plant engineering or maintenance. As a first step, the energy teams do a good job making people aware of energy usage. Because they are educated in how to reduce their energy at home, they get interested in it. This makes them ask questions about dimmable lights, motion sensors and reasons to turn down the thermostat.

Educating every employee on energy efficiency is a key strategy. The more comfortable employees are with the topic, the more ideas they come up with at home and at work. We conduct compact, fluorescent light sales for employees, and also hold multiple energy awareness fairs. At our last fair, they got a reduced price of $1–$2 per bulb! We incorporate ENERGY STAR and local companies focused on reducing energy and water consumption.

How does the energy team work together?

When I joined in 2008, we had a lot of separate efforts going on. A lighting project would be done in one facility, and then in another, and each had to do it from scratch. Now, we share ideas and experiences on what works. We hold monthly conference calls and have one annual in-person meeting.

We just did a modular boiler project and discovered we could do a heat recovery implementation from the compressed air. The challenge with heat recovery is in the impracticality of getting heat from here to there.

One of our facilities in Jefferson, Wisconsin, had already completed heat recovery projects with their painting system. They offered a lot of good ideas on how to implement this heat recovery opportunity.

There is a corporate budget for energy efficiency projects. When they are looking for a project they can't fund, they will turn to us. Corporate monies consider projects with a payback of two years or less. Energy projects are viewed as any other cost reduction where lean manufacturing is applied. The projects support our commitment to sustainability. The ease of implementation is always a factor, as these projects do affect people and/or production.

THE ENERGY MANAGER

Sustainability Motors On at Briggs & Stratton

Can you give examples of sustainability projects?

Briggs & Stratton has been working tirelessly to eliminate waste from, and incorporate recycled materials into, its manufacturing processes whenever possible. Here are some examples:

- We've invested over $105 million in improving our impact in cleanliness of our products and operations in the past decade
- We use over 100 million pounds of recycled aluminum in the production of our products every year
- We have achieved a 50% reduction in hazardous waste over the last five years
- We use recycled cardboard and returnable containers for shipping
- We recycle over 250,000 gallons of oil annually
- We have saved 5.4 million kWh of electricity in facility lighting projects

Annually, the company recycles approximately 35,000 lbs. of computer and electronic devices.

Can you list some projects done by the energy team?

Our energy team has implemented projects that have saved nearly 30.1 million kWh (7.8M in 2007, 7.1M in 2008, 15.2M in 2009) over the last three years. We received significant levels of energy grants and tax deductions, which made the ROIs on these projects attractive:

- $562,710 in incentives from Wisconsin's Focus on Energy Program
- $1,189,419 tax deduction (2007 and 2008) under the Emergency Economic Stabilization Act of 2008 (formerly called EPAct 2005)

What is even more important is that the energy teams have established baselines, key performance indicators and goals. We have developed a long-range plan to continue to achieve energy reduction and to increase energy awareness. We also execute an ongoing program to recognize achievements, both at the plant level and corporate wide.

We feel that we have transitioned the energy management program from a variety of people maintaining energy project spreadsheets to a corporate-wide transparent commitment to sustainability. We create project lists in each facility with ease of implementation and also with costs and ROIs. We scale that out into short-term and long-range plans.

One compressed air energy efficiency project turned off 800 hp worth of air compressors!

What do the projects focus on at Briggs & Stratton?

The project areas cover lighting, compressed air controls and new VSD air compressors, furnace improvements (metal melt furnaces), boiler projects at three facilities (modular boilers at the Auburn facility), VSD motors added to motors and pumps, reducing compressed air and steam leaks and upgrading motors to NEMA premium motors. Even the ice machine can be made more efficient, and it's been pointed out to us!

Please describe some compressed air energy-efficiency projects.

We had one significant project in Missouri where we were able to turn off two Centac centrifugal air compressors (one 800 hp and one 500 hp)!

We had two buildings operating with independent compressed air systems. One building had three Centac's (800 hp, 700 hp, 500 hp) venting compressed air out the roof while the other building had three 100 hp air compressors (one a VSD). We suggested they connect and network the two systems into one system using a large underground pipe and automated controls. This did the trick and enabled us to turn off the two centrifugals.

We have leak audits on-going in all the facilities. Some programs are more formal than others. Some have quarterly leak checks and some have monthly checks. Some are done by the local utility and some are subsidized by Wisconsin's Focus on Energy. They will pay for the leak check (75%) and when (not if!) you get them repaired, they will pay another 75% of the repair bill.

We also recognize "leak finders" by using three-part leak tags. Of the three-part tags: one goes to maintenance, one stays on the leak and the third is for the leak finder to put into a pizza raffle! We have fun with leak prevention programs at the plant level.

What future projects do you have in mind?

We will continue with lighting projects, like the one we did here in Milwaukee where we put 3,000 new fixtures in the production and office areas. Motion sensors are installed on 2,700 of the fixtures. Because our production changes so much it becomes too challenging to program a groups of sensors.

We are trying to transition from natural gas furnaces to electric units in a few unique applications. They are more efficient and also more versatile. We are looking at some dual-capability furnaces as well. We use the furnaces to melt metal.

Air conditioning is being reviewed as a priority in our southern plants, as well as our spray and dunk washers, which we use to clean oil off of parts. These washers are heated by steam, and we are working to lower the required temperatures.

Boiler systems will be a continuation of what we are already doing. We've done some big projects like the modular boilers in Auburn, AL (a redesign of the HVAC system is in order here in Milwaukee). We have good ideas for the furnaces and boiler systems at other plants.

With compressed air, I feel like we are 30%–40% there. We need to focus on controls, as some facilities are still using manual controls. The compressors themselves can be staged better. We do own efficient air compressors. We'd like to work on storage, demand-side applications and inappropriate uses of compressed air, like blow-off applications. The good news is that we have employees identifying and telling the energy team about all these opportunities!

How does Briggs & Stratton report energy efficiency?

The Environmental Department led by my boss, John Mourand, gathered most of the data for the Global Reporting Initiative (GRI). It was very useful to us because it provided benchmarking on what other companies are doing. GRI provides a questionnaire and results on their web site. There was no cost.

It became a framework for putting sustainability reporting together. We use that framework for benchmarking against other companies.

We recently became a "Save Energy Now" LEADER with the DOE. That involves making a pledge regarding energy used per product produced. Our pledge is to reduce our energy intensity by 25% over 10 years. It is a lofty goal for us, and it will take the dedication and focus we have developed over the past three years. BP

Thank you and congratulations on your program.

For more information, contact Rod Smith, Compressed Air Best Practices®, Tel: 251-680-9154, email: rod@airbestpractices.com, www.airbestpractices.com.

"Our Energy Team has implemented projects that have saved nearly 30.1 million kWh over the last three years."

— Richard Feustel, Corporate Energy Manager of Briggs & Stratton

THE TECHNOLOGY PROVIDER

Food Industry Expertise at Parker domnick hunter

BY COMPRESSED AIR BEST PRACTICES®

Compressed Air Best Practices® spoke with Nick Herrig (Sales & Marketing Manager), Rob Glover and Mark White (Training Manager), of the Parker PDF (Purification, Dehydration, and Filtration) Division.

Good morning. What's new at Parker domnick hunter (dh)?

Good morning. We recently announced the formation of the new Parker PDF (Purification, Dehydration, Filtration) Division. This new Division merges Parker domnick hunter & Zander North America with Parker Airtek, and creates one Compressed Air & Gas Purification Team to serve the North American market.

The responsibility of the Parker PDF Division is to further develop our market-leading brands of domnick hunter, Zander and Airtek. From a technology standpoint, we believe that the new division offers the most comprehensive and diversified product portfolio in the compressed air and gas purification market.

Please describe the market you serve.

Compressed air is often called "the 4th utility." When factories want electrical power, they just plug in. With compressed air, the facility has to specify, install, manage and maintain the utility. In order for compressed air to be a usable, efficient and productive energy source, the responsibility falls upon the shoulders of each individual plant. This makes compressed air a unique "utility."

It is the compressed air purification equipment installed in the compressor room and at the point of use which determines the quality of this power source. It also plays a major part in determining the efficiency and cost effectiveness of this utility. This is the market we serve. The Parker PDF Division provides the education and purification technologies required to use compressed air productively, efficiently and safely.

Why is compressed air purification necessary for every compressed air system?

Compressed air contaminants can cause disruptions (product spoilage, downtime) to manufacturing operations and create elevated energy costs to run the system. Most people think of just water, dirt and oil when they consider compressed air contaminants. There are actually 10 different contaminant types, and it is our primary focus to help operations understand them and take actions to eliminate them. Our focus is on preventing disruptions to plant operations by ensuring the supply of high-quality compressed air. We manufacture equipment capable of handling all contaminants and, just as important, our engineers counsel plant personnel on how to apply the technologies effectively.

Should there be a compressed air quality specification written for the U.S. food industry, similar to what the BCAS has done? If so, does the industry have any plans to do this?

There absolutely should be a specification for the food industry in the U.S. When we go to food plants, each system is different and a compressor distributor working on their own drives the system design. Most systems have a high potential for contamination. We often see water and oil dripping out of the compressed air lines at the packaging machines. Look at some of the outbreaks recently (like the peanut butter facility in Georgia). Every major country has legislation that forces the producer to look at food hygiene. All require the use of the HASAP principle. The guy doing the risk assessment, however, sees compressed air as a utility. They don't see the contaminants or understand them. They have a duty to protect the consumer, but it's not being done in many instances. The pipe has 10 contaminants, but in this country you can't go to college and learn about compressed air. There is a 3A Standards Committee for the food industry. However, they have a very generic compressed air specification and we have approached them to discuss the topic.

Other than that, we are not aware of any current plans to develop a compressed air specification for the food industry in the U.S. We would welcome this development and would assist in any way that we can. Currently, we typically use the Code of Practice jointly developed by the British Retail Consortium and the British Compressed Air Society as the "next best thing."

THE TECHNOLOGY PROVIDER

Food Industry Expertise at Parker domnick hunter

What are some of the issues you see in the food industry?

The most common issue is that a high percentage of installations (where compressed air comes into contact with food products) use refrigerated dryers capable by design of only a 38 ˚F (3 ˚C) pressure dew point. In order to inhibit the growth of microorganisms and fungus, pressure dew point must be below -15 ˚F (-26 ˚C). For this reason, we always recommend a desiccant dryer, which can provide a -40 ˚F pressure dew point.

Microorganisms are one of the major contaminants of concern to the food industry. The moisture in compressed air creates an ideal habitat for harmful microorganisms and fungi. When the compressed air is dried below -15 ˚F, they are converted into a spore. These spores are then filtered by our filtration technologies.

How important is the compressor type to air quality?

A common misconception exists around the use of oil-free air compressors. We have visited facilities with oil-free air compressors installed with absolutely no filters and dryers. An oil-free air compressor alone is not a solution. You have removed only one of the 10 contaminants, namely the oil aerosol.

Air compressors draw in large volumes of atmospheric air containing airborne contamination such as water vapor, oil vapor, atmospheric dirt and microorganisms. Additionally, the compressor and the storage and distribution system add further contamination. This is the same for all types of compressors, and therefore the level of compressed air purification equipment required in a compressed air system is not dependent upon the type of compressor installed. Even with an oil-free compressor, adequate purification will still be required to remove the water vapor, water aerosols, liquid water, atmospheric dirt, microorganisms, oil vapor, rust and pipescale.

Air treatment requirements (for the food industry) do not depend upon the air compressor. Rather, they depend upon the application of the compressed air. It is critical to understand both the system design and the role for compressed air in order to define the purification methods needed. We break it down into three system designs: Contact, Non-Contact and Non-Contact High Risk.

How can end users use the ISO 8573.1 Standard?

The ISO 8573.1 Standard is designed to help operators of compressed air systems specify their purity requirements. By using this standard, a factory can be very specific to the prospective vendors as to what they want.

This standard also creates awareness about purity requirements. This opens up the opportunity to define purity requirements in different "zones" of the factory. In the past, all the compressed air purification was done in the compressor room and the factory lived with one purity requirement/specification. It was common to see huge pressure-swing desiccant dryers in the compressor rooms delivering -40 ˚F pressure dew point air quality to the whole factory. The downside to this is that often only 10% of the compressed air volume needed this level of air quality. The unnecessary energy costs to the factory were very large.

Today, we recommend that plants use the ISO 8573.1:2001 Standard to define what air quality is needed in which section of the factory. In this way, the above example could have used a desiccant dryer for 10% of the air load, and a refrigerated air dryer for 90% of the air load. The benefits in energy savings and maintenance costs would be significant to the factory.

A new code of practice covering the use of compressed air in the food industry has been developed between the British Retail Consortium and the British Compressed Air Society. The code gives minimum quality standards for compressed air and defines allowable levels for dirt, water and total oil in line with quality levels specified in ISO8573.1 the international standard for compressed air quality.

Quality Levels

Section 6 of the code of practice provides air quality standards for compressed air that is either in direct contact with food (specified in section 6.1 as contact) or air that could come in contact with food (specified in section 6.1 as non-contact).

Air Quality Recommendation	Dirt (Solid Particulate) Max Number of Particles per m³			Humidity (Water Vapor)	Total Oil (Aerosol + Vapor)	ISO8573.1 Equivalent
	0.1-0.5 micron	0.5 - 1 micron	1 - 5 micron			
Contact	100,000	1,000	10	-40°F(-40°C) PDP	< 0.01 ppm	Class 2.2.1
Non - Contact	100,000	1,000	10	+37.4°F(+3°C) PDP	≤ 0.01 ppm	Class 2.4.1
Non - Contact High Risk	100,000	1,000	10	-40°F(-40°C) PDP	≤ 0.01 ppm	Class 2.2.1

Reference Conditions from ISO8573.1 : Absolute atmospheric pressure 14.5 psi (1 bar), Temperature = 68°F (20°C). Humidity is measured at air line pressure.

In addition, section 6.2 gives advice on assessing microbiological contamination.

Lubricants

Section 5.4.4a of the Code of Practice states 'Where lubricated or oil-injected compressors are in use and non-food grade oil is used and the HACCP process identifies a risk, then the oil shall be replaced with food grade oils in line with the procedures identified in the EHEDG Document 23.'

Please note that ISO 8573.1:2001 is the latest edition of the standard. Ensure that it is written in full when contacting suppliers. Specifying air quality around previous editions of the standard may result in a lower quality of delivered compressed air.

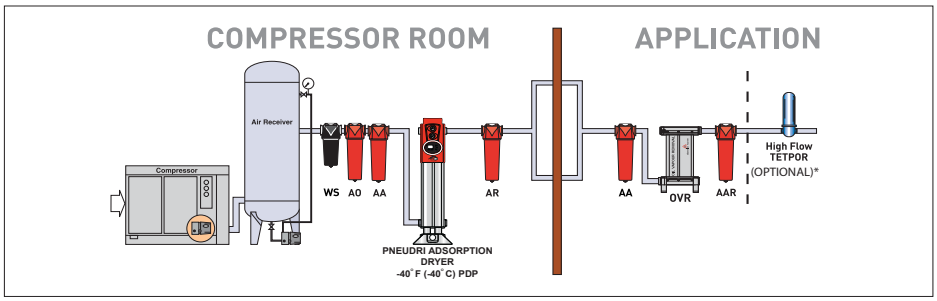
How can factories use the ISO 12500 Parts 1–3 Standard to their benefit?

This standard is critical in helping factories know that they are purchasing a high-quality product. We highly recommend that factories request a written confirmation from their vendor saying that their coalescing filters were tested in accordance with ISO 12500.1.

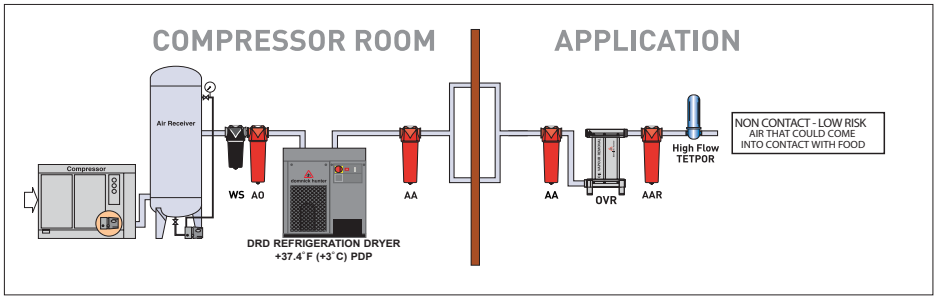
Coalescing filters are probably the most important items of purification equipment in a compressed air system, as they are designed not only to remove aerosols (droplets) of oil and water, but also to remove solid particulate and microorganisms. For this reason, ISO 12500.1 is of utmost importance.

ISO 12500.1 has introduced two challenge concentrations of oil aerosol to be used when testing coalescing filters: 40 mg/m^3 and 10 mg/m^3. The new standard requires filters to be tested using the existing test method and equipment shown in ISO 8573.2 while using one of the two challenge concentrations. In addition to this, ISO 12500.1 requires filters to be "wetted out," which is representative of an operational filter. Recording of the filter's initial saturated pressure drop has also been included, again to give a more accurate and representative indication of the filter's operational costs. Three examples of each model requiring validation must be tested and each tested three times. Published performance data is then based on calculating an average of all of the tests in order to provide the person selecting a new product with a more representative indication of performance.

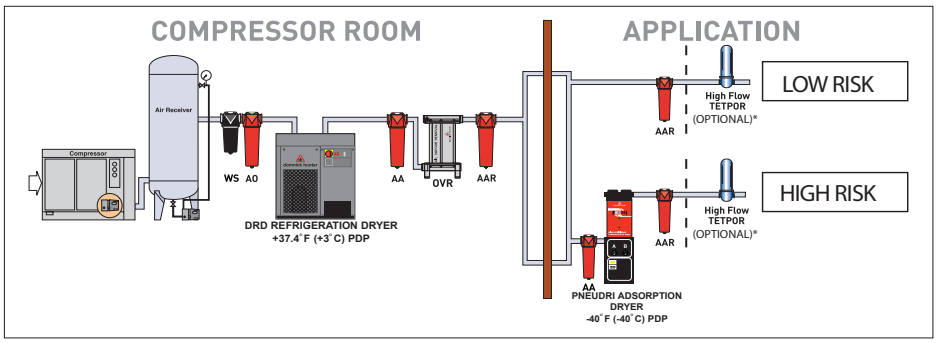
CONTACT



NON-CONTACT



NON-CONTACT



Let's discuss energy cost saving opportunities with filters.

We focus on ensuring compressed air quality at the lowest required energy costs. There are ways to do this when one examines filtration and dehydration of compressed air systems.

With filtration, the focus is on pressure loss. Remember the rule of thumb that you need one (1) horsepower to create every two (2) psi. If you need 100 psi pressure to run a machine, you might have to run the air compressor at 120 psi to overcome the restrictions to the air flow created in the filters, dryers and piping system. When we look at filtration energy costs, we look at differential pressure.

Our high-efficiency filter is rated at 3 psi saturated, and we suggest changing it at no less than 5 psi saturated. A lot of competitors say 10–12 psi. Most filter elements start at 5 psi. We suggest a target of maintaining a 5 psi differential. Our elements are designed to maintain less than a 5 psi delta-p for 12 months.

Our initial starting delta-p is the same as any other brand. They all provide a specific air quality at a reduced delta-p ***when first installed***. The difference comes after a few hours, when the element is saturated. Parker domnick hunter designs have up to 450% more material in the oil coalescer filter element. This means that 12 months down the road, this element can hold 450 times more dirt — which would equate to 60% energy savings.

THE TECHNOLOGY PROVIDER

Food Industry Expertise at Parker domnick hunter

It is important that factories don't use initial pressure drop when comparing filters, but instead use saturated pressure drop. We also recommend that factories ask their supplier to provide data on "saturated pressure drop after 12 months of running time under given inlet challenges."

We nevertheless pull away from changing elements on pressure drop. People buy filters for air quality, but the delta-p measurement is on pressure drop. After a certain period of time, filter media can rupture and the delta-p won't reflect the loss in air quality. We recommend changing filters based upon time used, not on delta-p. We recommend changing the element every 12 months. Just relying on the gauge can be dangerous to air quality. Maintenance is busy, and if they see a green gauge and there is a tear in the media, bad things can happen downstream.

When should a customer purchase a mist eliminator vs. a coalescing filter for oil removal?

The functions of these filters overlap, but they do a different job and are not designed to deliver the same air quality. A mist eliminator should be used as an insurance policy against the compressor air/oil separator failing. It is designed to remove large amounts of liquid oil and some of the oil aerosol, protecting the downstream coalescing filters from overload.

There are firms focusing on energy audits and energy costs, and we know they tend to recommend mist eliminators as the method to eliminate oil with a lower pressure drop. Our primary goal is on high-quality compressed air and to ensure this, we recommend that fine oil coalescing filters be used. Air quality is not a given, and mist eliminators do have design limitations.

Compressed air dryers must always be protected by a general purpose and high-efficiency coalescing filter. Otherwise, liquid or aerosols may get into the drying bed, providing poor dew point, or even destroying the costly desiccant bed completely. We see the need for both of these products in the system, but one should not be used to replace the other.

Where are the savings to be found with dehydration?

As with most technologies, the answer lies in the correct application of the technology. Earlier we discussed when to and when not to use a regenerative (desiccant) air dryer. The lower dew points offered by desiccant dryers are absolutely necessary for certain applications, yet caution should be taken to not apply this specification then to the whole factory.

With refrigerated dryers, we manufacture both cycling and non-cycling designs — so we are impartial from a technical standpoint. A cycling refrigerated dryer usually has a larger power requirement when working at full load. When you run it at full load, it will cost more than a non-cycling dryer at 60–100% of load (as a rule of thumb). Yet, there are intermittent-use applications where the cycling dryer will save energy for customers. The key is in the proper application. It's also important to understand the pressure loss in a dryer. In the field, we see significant differences in this area. BP

Thank you for your insights.

For more information, please contact Jane Sexton, Parker domnick hunter, Tel: 1-800-345-8462, email: Jane.Sexton@parker.com, www.domnickhunter.com.

THE SYSTEM ASSESSMENT

Why Do Steam Traps Fail?

BY BRUCE GORELICK, ENERCHECK SYSTEMS AND ALAN BANDES, UE SYSTEMS, INC.

Properly functioning steam traps open to release condensate and automatically close when steam is present. Failed traps waste fuel, reduce efficiency, increase production costs and compromise the overall integrity of the steam and condensate systems. Traps should be tested on a regular basis — or the neglect may be quite costly.

Steam energy conservation is important to our national interest. Examine the government figures below:

- Over 45% of all the fuel burned by United States manufacturers is consumed to raise steam. Steam is used to heat raw materials and treat semi-finished products. It is also a power source for equipment, as well as for building heat and electricity generation. But steam is not free. It costs approximately $18 billion annually to feed the boilers generating steam.
- Many manufacturing facilities can recapture energy through the installation of more efficient steam equipment and processes. A typical industrial facility can realize steam savings of 20% by improving their steam system. If steam system improvement were adopted industry-wide, the benefits would be $4 billion in fuel cost reduction and 32 million metric tons of emission reductions.

Source: U.S. Department of Energy. Energy Efficiency and Renewable Energy.

Failed Steam Traps Negatively Impact the Entire Steam System

- Waste Energy
- Adversely Affect Production
- Increase Maintenance Costs
- Create Safety Issues

THE SYSTEM ASSESSMENT

Why Do Steam Traps Fail?

A 600 psi-rated steam trap being ultrasonically tested

After an ultrasonic test found the trap to be blowing, the downstream condensate line was shut and the test valve was opened to verify test results. The system pressure was 270 psi. At the cost of $10.00 per thousand pounds of steam produced, the energy loss for this single blowing trap is a whopping $21,000.00

Why Do Steam Traps Fail?

Obviously, anything mechanical will malfunction, and steam traps are no exception to the rule. Proper maintenance improves longevity and helps reduce maintenance costs.

There are three general conditions that adversely affect traps:

1. Dirt — by far the leading cause of failure resulting in either a leaking or plugged trap.
2. Pressure surges (due to sudden steam valve openings, improper piping or trap misapplications) resulting in water hammer and subsequent damage to the internal steam trap components.
3. Over-sizing IB traps can lose their prime; TD traps can experience rapid cycling.

How do we keep problems to a minimum and keep energy costs in check? One simple way is to look for warning signs. Let's review the most evident signs that should signal a distress call from your steam system.

1. The once lazy plume from your condensate stacks is now an out of control freight train. The steam that is standing at attention from your stack, like a soldier, is costing you dearly.
2. Condensate backpressures that have slowly been rising have been causing your electric condensate pump to self-destruct. Conventional electric pumps cannot handle high-temperature condensate. Temperatures over 212 ˚F cause conventional electric condensate return pumps to cavitate. Motors burn out and mechanical seals begin to leak when steam is present.
3. Pressure reducing valves (PRVs) or control valves fail to maintain set pressures. Fully or partially plugged traps prevent condensate from being eliminated from the steam space. Un-drained condensate at PRV stations will back up into the steam line and wiredraw the heads and seats of the reducing valves. Wiredrawing is when high-velocity water in the steam system cuts (or scores) the surfaces of heads and seats. Even small microscopic cuts will prevent the proper operation of these valves.
4. A production capability has been reduced. Open or closed traps that have failed will negatively impact production. Plugged traps will back condensate up into the process and dramatically reduce system efficiency. Blowing and leaking traps are costly to production due to added and unnecessary energy consumption.
5. Pipe wall thickness of the condensate system has become an issue. Fully open or partially opened steam traps that are not repaired in a timely manner will deteriorate the condensate return piping. Some of the early warning signs begin with steam leaks.

6. The cost to maintain heat exchanger bundles, humidifiers, HVAC coils and other equipment has dramatically increased. Failed traps will prevent proper operation of sensitive equipment. When steam traps fail in a closed position, over time, the stagnant condensate will turn to carbonic acid (CO_3). Carbonic acid will deteriorate all of the metal it comes in contact with. Beyond increased energy consumption, failed open traps will also cause control and efficiency issues.

7. Water hammer can develop in neglected or mismanaged steam and condensate systems. Water hammer literally sounds like someone is hitting a pipe with a hammer. In some cases, water hammer can occur when a portion of the steam condenses into water within steam piping. Left un-drained, condensate will spill into the steam system and begin to accumulate. Eventually a wave of water will be created. This slug of water can be carried at high velocity until it reaches an obstruction like a closed valve, a lower elevation or a sudden change of direction.

   A trap that is blowing steam can also cause water hammer. Blowing traps create backpressure in the condensate system piping. If condensate piping is already undersized, the problem will be compounded by the additional pressures found by the faulty traps. Un-drained condensate can back up into the steam distribution piping. From the standpoint of plant safety, it is essential to test and maintain the steam trap population. Type "steam water hammer accidents and fatalities" into a search engine — the results should be convincing enough to create an immediate action plan.

Proper maintenance improves longevity and helps reduce maintenance costs.

The Action Plan

- Perform a regularly scheduled steam trap survey
- Identify system design issues
- Perform an insulation audit. Areas where insulation has been removed and never replaced will significantly add to your overall steam production costs
- Using ultrasound detection equipment, test bypass valves if they exist in your steam system. They may be leaking through when they should be shut
- Turn off seasonally operated equipment, such as unit heaters
- Periodically test control valves or shut off valves in the HVAC system with a hand-held IR temperature instrument and an ultrasonic leak detector. If they are even partially leaking through, they are adding to overall energy costs
- Audit the system and unused inventory equipment and remove defunct systems
- Whenever possible and practical, use a computerized system to control and monitor processes

Purchase Proper Test Equipment

Even if outside technical professionals are contracted to test the steam system, from time to time a problem will still occur. Time is money. Having the proper equipment and just one trained employee can avoid costly downtime. The two basic pieces of equipment to own are an infrared thermometer and an airborne ultrasonic instrument. Such equipment is readily available in all price ranges. A thermometer with simple features is fine, however, an ultrasonic listening device should be selected more carefully and must have clear signal quality.

THE SYSTEM ASSESSMENT

Why Do Steam Traps Fail?

A typical industrial facility can realize steam savings of 20% by improving their steam system.

This is similar to purchasing an audio system for your home and comparing one set of speakers to another set. When listening to a quality speaker system, the nuances of what was actually recorded open your ears to a new level of listening. The same is true of listening to a steam trap. With a fine instrument, you can even hear the "snap, crackle, pop" of steam passing across the head and seat of a wiredrawn inverted bucket trap. After all, "hearing is believing."

Before You Begin

Before you spend your hard-earned money, consider some of the following characteristics of the ultrasound instrument:

- How is the sound quality heard through the headphones? External speakers will be hard to use in most steam environments
- Does it lack versatility (will it include the ability to change frequencies and test modules)?
- Is it heavy and/or awkward to handle when up on a ladder?
- Does it have an extended warranty period?
- Is there proper technical support via phone or in the field?
- Can batteries be easily charged and replaced?
- Are trial rentals available?

Purchasing an ultrasound device should take intelligent consideration. The instrument must be capable of providing you with a clear and discernable signal quality. Labor hours and equipment costs depend on it.

Why Use Ultrasound to Test Traps?

Of all the inspection methods, ultrasound is the most recommended and reliable. Ultrasound is a shortwave, high frequency signal that does not travel far from its source. By listening to the ultrasonic components of a working steam trap, a user can isolate the signal and easily identify operational sounds. Ultrasonic testers translate high-frequency emissions generated from the mechanical and fluid flows of traps into the audible range where they are heard through headphones and seen as intensity levels on a meter. Some units have frequency tuning to filter out additional signals and to tune in to the sounds of steam and condensate. Testing steam traps with ultrasound provides results in real time. It isolates the area being tested by eliminating confusing background noises. A user can quickly adjust to recognizing differences among various steam traps.

The ultrasonic detector may be the easiest to use, most flexible and most accurate of the sound testing methods. However, the ultrasonic instrument cannot tell if a trap is cold or blocked. Therefore, first use a temperature indicator instrument to be certain that the system is operating. Then, use the ultrasound instrument to determine if the trap is partially blocked or if backpressure exists at the traps outlet. BP

Bruce Gorelick is the Vice President for Enercheck Systems, Charlotte, N.C., and Alan Bandes is the Vice President of Marketing for UE Systems, Elmsford, N.Y. For more information about these organizations, please visit www.enerchecksystems.com and www.uesystems.com.

SEVEN SUSTAINABILITY PROJECTS FOR INDUSTRIAL ENERGY SAVINGS

Project #7: Project Implementation

BY THOMAS MORT, CEM

Overview

This month's article reviews the seventh of the key elements for low-cost/high-value energy savings. Each of the previous articles reviewed types of projects that are applicable to many facilities. The projects ranged from simple procedural actions, such as turning off equipment when it is not making a product, to more complex solutions, like adding water to an air heat exchanger and extracting heat from the coolant loops to provide warmed make-up air.

Seven Key Sustainability Projects

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

Energy Projects Require Resources, Too

Something that is important to remember is that even simple projects require resources, such as time, labor and opportunity. More complex projects require even more, including engineering, time, labor, opportunity and capital funds. I often find that energy cost reduction projects are not treated in the same manner as other projects, such as the installation of a new assembly line. When a plant is going to install a new line, formal project management steps often include a detailed tracking program like MS Project. When it comes to energy projects, however, they often seem to be unorganized, and project management skills are ignored or neglected.

SEVEN SUSTAINABILITY PROJECTS FOR INDUSTRIAL ENERGY SAVINGS

Here are the general steps that I use to analyze a plant with the goal of developing an **Energy Cost Reduction Plan** that will meet my goal of **10% reduction**, with projects and actions averaging less than a **one-year payback**.

1. Determine the annual energy costs for electricity, gas, water and sewer, and use 10% of this cost to set the target savings (example: total annual costs of $450,000 x 10% = $45,000 target savings).
2. Perform assessments and collect measurements in the six key areas discussed in previous articles: Metrics, HVAC, Lighting, Compressed Air, Demand Control and Heat Recovery.
3. From the measured data collected, perform analysis to determine the potential savings for each of the key areas.
4. Since the goal is to have a payback of less than one year, use the savings number to set the maximum cost for the project (for our example, the total implementation costs are limited to $45,000).
5. Use this maximum project cost as a "boundary" for developing the action or implementation plan. If you require outside support, such as quotes from a supplier, give them this boundary and explain that their quotation must be within the boundary to be accepted. The implementation plan should be as rigorous as a plan for a new assembly line would be (remember that all projects require some form of resources, so be sure to include the resources required for each project, even the ones that do not involve an appropriation request).

When I start a project with a new company, one of my first steps is to review their on-going energy conservation projects. What I usually find is that even though there is a corporate goal to reduce energy costs, there is not a sufficient "basket full" of qualified projects to meet that goal. My job is to make sure there is a basket full of projects that will, when completed, exceed the target goal.

Some important items that should be in all proposed projects include:

1. A brief description of the project, including the current situation, the proposed action and the expected results.
2. A clear measurement to show the baseline and how savings will be measured.
3. Savings calculations, including assumptions and unit costs of energy.
4. Implementation costs, including quotes and resources (time, labor, engineering and opportunity).
5. A timeline with measurable milestones. Organize the project so that it can be partially implemented for validation. Then, if the validation meets the goals, continue the project.

Seek Efficiency Incentive Funding

Energy Cost Reduction Projects cost money. Funds are often available to promote energy reduction or emissions projects. Part of the research and planning for a project needs to include checking for available funds. These usually come in the form of either a Government Tax Rebate or Utility Funds.

A very good place to start is at the Database of State Incentives for Renewables & Efficiency (DSIRE).
www.dsireusa.org

DSIRE is a comprehensive source of information on state, local, utility and federal incentives and policies that promote renewable energy and energy efficiency. Funds are available for energy audits, compressed air projects, lighting, motor upgrades and HVAC improvements.

As an example, with the Wisconsin Focus on Energy Program, a plant that gets an outside compressed air audit can apply for an incentive for 50% of the audit costs (up to $7,500). A plant that replaces a primary air compressor with a new VSD air compressor will receive $25,000 per project. For this program, a site would apply for the incentive within 30 days of installing the VSD compressor and removing the old compressor. In some cases, amounts greater than $25,000 are awarded, but written approval must be given prior to the installation. Funds of up to $500,000 are available per Corporate Tax ID.

"Treat energy cost reduction projects with the same level of importance as a construction project or new assembly line. Use the normal project management protocols. Take advantage of government and utility rebates. Make sure your projects include measurement and verification as part of the plan, along with a validation "small step" before diving into a large project."

EPAct 2005 incentives are tax deductions that enable a company to accelerate the depreciation of the capital expense in the current year, which is an advantage for profitable companies paying federal tax. The deduction is up to $0.60/sq. ft. for projects involving interior lighting, HVAC and building envelope improvements up to a total of $1.80/sq. ft per facility. This program has been extended and is available through 2013 as a part of the American Reinvestment and Recovery Act of 2009. In most cases, a properly licensed contractor will be able to certify that a site meets all of the requirements for a deduction.

Note: Your project may not fit exactly into one of the pre-assigned categories, but there is quite a bit of flexibility in the utility programs, and if you work together with the utility, you can often still get your project approved. In Michigan, a plant recently applied for funding of a heat recovery project using a water-to-air heat exchanger. The utility company approved the project, paying 50% because it helped reduce natural gas usage.

Demand-Response Is Another Way to Receive Funding

Demand-Response is a method of managing consumption of electricity when there are conditions of high demand or high prices. If contacted, utilities agree to pay a price per kWh to a consumer willing to curtail a certain amount of their load. While Demand-Response is not an energy reduction initiative, participation can reduce the amount of money spent on electricity. Demand-Response is managed by third-party providers who install the metering necessary to verify the load level during an event, notify all participants prior to the event and manage the payments. The approved Demand-Response providers depend upon the specific electric power market for a region.

The rules for participating in Demand-Response vary by region. For example, within PJM Interconnect, the program runs from June through September. There can be no more than 10 events called and no single event can last more that six hours. In 2010, PJM plans to pay $174.29/MW per day, which is $63,615/year payment for a curtailment of 1,000 kW. This will be paid even if no events are called. In contrast, the TVA program offers 40-hour and 80-hour plans for Demand-Response. In this case, there will definitely be curtailment calls. Depending on the specific program within the TVA plan, a participant can receive from $15,000 to $40,000 for 1MW load. The Demand-Response provider will keep a portion of the payment as agreed in the contract for services, which ranges from 25%–40%. If an event is called and a participant is not able to curtail load, for whatever reason, there are penalties. However, typically the Demand-Response provider will cover these penalties. Important points to cover during contract negotiations include the percentage of the payment the provider will keep, how the baseline will be set to measure the load shedding, how penalties will be handled and how the metering will interface with your site network.

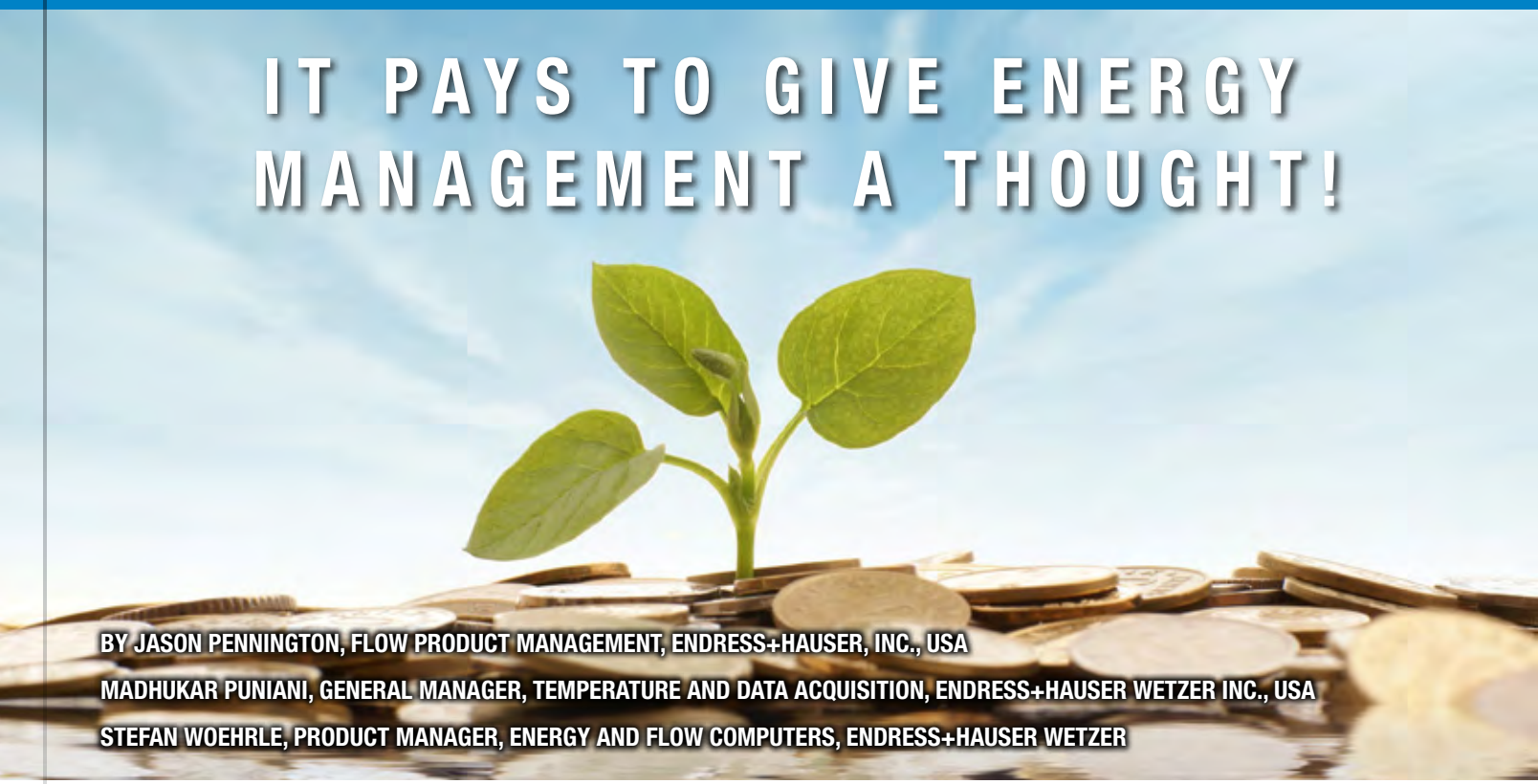
Map of Regions; http://www.ferc.gov/market-oversight/mkt-electric/overview.asp

Summary

Treat energy cost reduction projects with the same level of importance as a construction project or new assembly line. Use the normal project management protocols. Take advantage of government and utility rebates. Make sure your projects include measurement and verification as part of the plan, along with a validation "small step" before diving into a large project. BP

For more information, please contact Thomas Mort, CEM, Thomas Mort Consulting, Tel: 210-858-8454, email: tcmort@savingwithenergy.com, www.savingwithenergy.com.

IT PAYS TO GIVE ENERGY MANAGEMENT A THOUGHT!



BY JASON PENNINGTON, FLOW PRODUCT MANAGEMENT, ENDRESS+HAUSER, INC., USA
MADHUKAR PUNIANI, GENERAL MANAGER, TEMPERATURE AND DATA ACQUISITION, ENDRESS+HAUSER WETZER INC., USA
STEFAN WOEHRLE, PRODUCT MANAGER, ENERGY AND FLOW COMPUTERS, ENDRESS+HAUSER WETZER

Energy savings from compressed air system improvements can range from 20–50% or more of the current electricity consumption.

Part 1 — Accurate Measurements

In the first section, we will talk about accurate measurements as the first step in monitoring energy and reducing uncertainty. More specifically, we will concentrate on better energy measurement using precise differential flow measurement and establishing benchmarks through correct strategies.

I. Differential Pressure Measurement

We concentrate on differential flow as it is one of the most widely used methods on account for reliability, simplicity, economics and, most importantly, standardization! The two popular and accepted standards are ISO EN 5167 and AGA 3.

Unfortunately, traditional disadvantages, such as low accuracy and limited range, are tolerated. This, of course, has a big negative impact on energy management. Through precise numerical calculations, it is possible to get past these disadvantages and achieve a level of accuracy not comprehended until a few years ago.

Data acquisition systems (DAS) enables a high degree of flexibility and mathematical calculation capabilities to better record, analyze and monitor data and generate early warnings and alarms. This allows operators and plant supervisors to run the plant more efficiently and reduce down time through information and diagnosis, well in advance of impending troubles in the various systems involved.

Combining better measurement and advanced data acquisition, the power lies in your hands to improve efficiency and energy management at your site!

Endress+Hauser

II. Flow Measurement According to the Differential Pressure Principle

The basic equation for the calculation of flow from differential pressure is as follows:

$$Q_m = C \cdot \sqrt{(1/1-ß^4)} \cdot \varepsilon \cdot d^2 \cdot \pi/4 \cdot \sqrt{(2 \cdot \Delta P \cdot \varphi)}$$

$C =$	Coefficient of discharge
$\varepsilon =$	Expansibility factor
$ß =$	Diameter ratio
$\varphi =$	Density in operating conditions
$\sqrt{(1/1-ß^4)} =$	Velocity of approach factor
$d =$	Diameter
$P =$	Pressure

All coefficients have dependencies to pressure and temperature.

The discharge coefficient C corrects the theoretical equation for the influence of velocity profile, and the assumption of no energy loss between taps and pressure taps. The velocity of approach and the expansibility factor incorporate the influence on density and flow rate due to the flow through the primary element. For the practical application, this equation is simplified. It is assumed that the pressure and temperature do not vary much from the specified conditions for design. Thus, all coefficients are combined to make a constant. As a result, one gets a flow directly dependent on the differential pressure. Thus:

$$Q_m = k \cdot \sqrt{(2 \cdot \Delta P)} \text{ (Simplification)}$$

As soon as the process conditions vary from the design conditions, an error is introduced into the calculated flow.

The discharge coefficient, expansibility factor and especially the density vary with temperature and pressure.

III. Calculating Errors Introduced Due to Simplified Calculation

The following example demonstrates the effect of varying process conditions on the flow calculations and the magnitude of introduced error for different fluids when using the simplified equation as compared to the original equation.

As representative and widely used media we use a steam measurement example.

How does the variation of pressure and temperature alter the flow measurement using the differential pressure and energy balancing?

Example:

Accuracy of a steam flow measurement using an orifice plate. Orifice plate in Pipe inner diameter. 200mm; (8-inch steam line).

Sized for:

FLOW RANGE	1,500–6,785 m³/h (54,000- 250,000 Cu ft/hr) DP range (38–838 mbar or 15.2-336.4 inches of H_2O)
DESIGN CONDITIONS	
PRESSURE	10 bar (145 psia)
TEMPERATURE	200°C (392 °F)
DENSITY	4.85 kg/m³
FLOW	4,000 m³/h (145454.5 chf/hr)
PROCESS CONDITION	
PRESSURE	10–12 bar (145–172 psia)
TEMPERATURE	190–200 °C (374–392 °F)
DIFFERENTIAL PRESSURE	270 mbar (108.4 inches of H_2O)
MEASUREMENT AS PER THE SIMPLIFIED EQUATION	
MASS FLOW	19.41 t/h (metric)= 21.4 (US ton/hr)
DENSITY	4.85 kg/m³
IMPROVED OR FULL COMPENSATION DIFFERENTIAL PRESSURE CALCULATION (REAL FLOW)	
MASS FLOW	19.41–21.8 t/h (metric) = 21.4–24.03 (US ton/hr)
DENSITY	4.85–6.08 kg/m³

The error due to simplification: approximately 12%

Other factors:

The deviation due to temperature in the size of the pipe and the flow element are minimal, and only when delta temperature is around 50 °C (122 °F) from the design point does it have a significant influence. The resolution and accuracy of pressure transmitters in today's times is fairly limited, as leading manufacturers offer accuracies of 0.075% of the end value. This allows flow ratios of 1:4 measured without any relevant influences. To achieve higher range and dynamics, we authors suggest multiple transmitters to increment range and resolution. This is also called splitting range.

Accurate temperature measurement for tighter control

This is one area, sadly, that is largely neglected in many plants. The temperature measurement technology has evolved over the years to offer great benefits in accuracy. How does this help? With more accurate temperature measurement, you can reduce the hitherto accepted bandwidth of 5–10 degree error. For example, the Type K thermocouple most widely used can easily be replaced by a much more accurate Type N thermocouple.

IT PAYS TO GIVE ENERGY MANAGEMENT A THOUGHT!

Any good strategy is meaningless without implementation.

Imagine the huge amounts of reduction in cost to heat your plant and the reduction in re-work through accurate control of critical temperature measurements. For highly critical applications, consider the modern transmitters that allow drift monitoring and automatic changeover to secondary back sensors.

Energy Management Step 1 — Benchmarking

It would be too simple and short-sighted to state that better measurements equate to better efficiency. In fact, improving efficiency can only take place if a sound plan for action is in place. This means evaluating the overall situation and making intelligent recommendations for short-, mid- and long-term improvements. The capability to support benchmarking, allocation and balancing strategies is the perfect compliment to improving measurement performance (See Figure 1).

Information-producing tools like Energy Management Computers, Software, Visualization and Recording Devices and Telemetry systems (see Figure 3) enable the assessment of energy consumption and plant efficiency as a first step toward leveraging improved plant performance. They provide the basis for intelligent decision-making about the priority of your investments, and can even demonstrate the impact of cost savings before the strategy is fully implemented

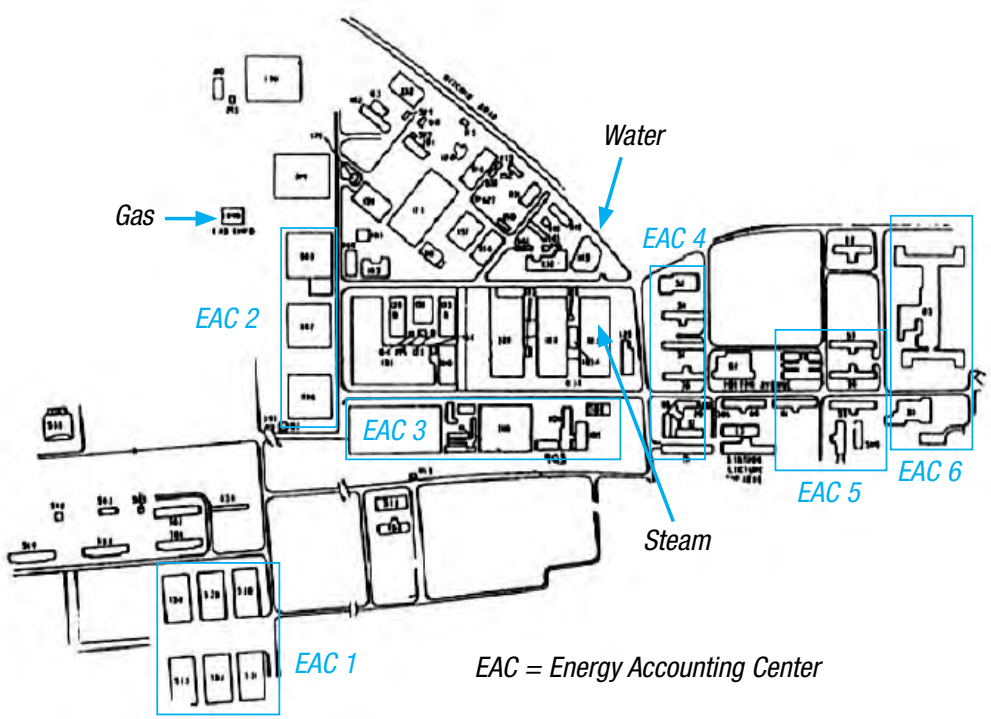


Figure 1. Represents a typical industrial facility segment by Energy Accounting Center (EAC). With this method, specific analysis by user, product and utility can be determined and benchmarked against similar applications or different sites within a company.

into your plant control and reporting architecture (see Figure 2). Furthermore, they enable the preparation of data for evaluation and decision-making without a significant investment and assist in identifying the priorities for the overall energy usage reduction plan. An additional benefit of making costs available at a localized level in a plant is that it increases the awareness of the plant operators. It can also help you make them more accountable by rewarding good behavior, which can foster a great employee culture, and that goes a long way in continuous improvement and cost consciousness.

Saving costs through high efficiency also saves our environment and reduces the burden on the national deficit. After all, most of the energy is made from fossil fuels that form a large part of our imports in the United States.

Energy Management Step 2 — Action plan

After installing the right monitoring and recording equipment comes the challenge of analyzing the information and actually creating an action plan for energy reduction at the plant. Any good strategy is meaningless without implementation. For smooth implementation, the stakeholders must be involved — from the plant operator to the CEO. This will mean first educating the whole team on the possibilities, based on the collected information on the plant. Then, during the time of implementation, the information and the achievements must be made public.

The action plan must target common areas of default and the chief energy users at the plant.

To create and implement an action plan, one must not only have solid information, but one must also understand the systems. To provide more insights into two of the most important plant-wide systems, we will continue with compressed air systems in the next part of this three-part series. In the final part, we will delve into the saturated steam systems at a plant.

When considering cost and efficiency optimization, look for a highly accurate flowmeter and/or energy computer that offers the complete compensation measurement and accurate density calculation based on accurate methods described above. Such a system, in coordination with a flexible monitoring and data acquisition system allowing early warning and easy analysis, will enable you to run your energy systems at high efficiency all year round and thus save high energy costs and reduce emissions. It is in our interest as responsible citizens to reduce emissions.

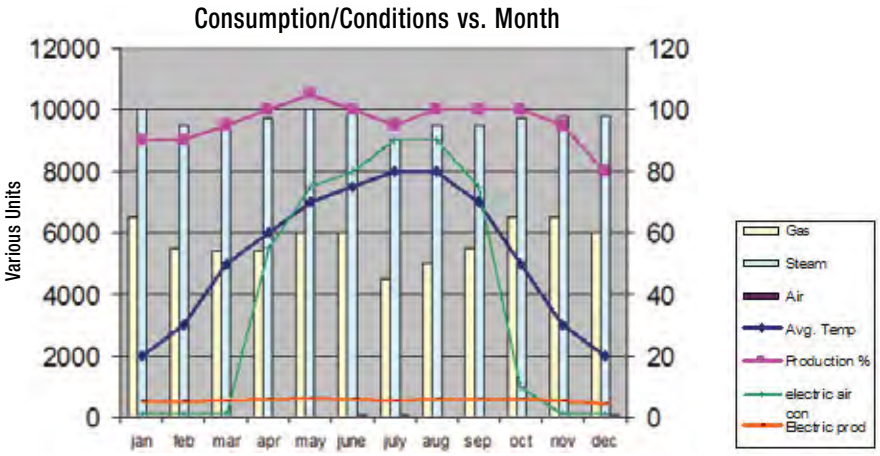


Figure 2. Represents a typical utility graph of usage vs. season for the facility in Figure 1. In this manner, utilities for production vs. climate vs. sales can be analyzed and differentiated based on overall requirements to ensure that production costs and utility requirements are on level playing fields.

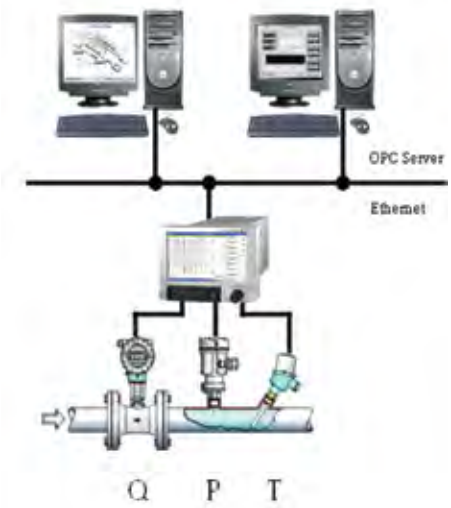


Figure 3. Represents a visual scada station (top) and energy recorder (bottom).

IT PAYS TO GIVE ENERGY MANAGEMENT A THOUGHT!

Figure 4. Represents a large scale and small scale industrial air compressor which can range from as little as 5 hp to 50,000 hp or more.

Part 2 — Monitoring and Managing Compressed Air

In the second part of this three-part series, we will talk specifically about compressed air systems.

After gas, water and electricity, compressed air is increasingly being considered the fourth utility at many facilities throughout the industry. Plant air compressor systems can vary in size from a small 5 hp unit to huge systems capable of more than 50,000 hp (see Figure 4). If you are in an industrial plant, a small machine shop or an immense pulp and paper mill, you are using some type of compressed air system. Constant pressure regulation, losses due to leakage and increased power to overcome moisture and non-essential users are only a few areas for potential improvement.

It is quite possible that the air compressors in your facility use more electricity than any other type of equipment (see Figure 5). Inefficiencies in compressed air systems are a source of financial loss. In many cases, however, the losses associated with compressed air systems are overlooked, underestimated or simply thought of as an unavoidable reality. When you consider the amount of air that never gets used, however, the cost to monitor vs. the cost of electricity to produce paints an entirely new financial picture.

SIC	INDUSTRY GROUP	GWh/YEAR	COMPRESSED AIR AS % OF TOTAL ELECTRIC USE
28	Chemicals and Allied Products	39,960	20.1%
33	Primary Metal Industries	12,609	8.3%
29	Petroleum and Coal Products	7,930	15.9%
37	Transportation Equipment	5,519	14.0%
30	Rubber and Miscellaneous Plastics Products	4,767	10.9%
26	Paper and Allied Products	4,533	3.7%
36	Electronic and Other Electrical Equipment	3,008	9.1%
20	Food and Kindred Products	2,898	4.5%
22	Textile Mill Products	2,392	7.2%
20–39	Overall Manufacturing	91,050	10%

Figure 5. Represents the overall allocation of electricity required to produce compressed air by industry. Source: U.S. Department of Energy (2003): Improving Compressed Air System Performance — A Sourcebook for Industry

The right equipment can help you diagnose the problems, develop a resolution plan and keep a tight check on your air system. Energy savings from compressed air system improvements can range from 20–50% or more of the current electricity consumption. Typically, those plants with at least 200 kW of generation and higher will realize the fastest rate of return on their investments. For your facility, this can relate to thousands, if not hundreds of thousands, of dollars per year. Depending on its use, a properly maintained and monitored

compressed air system can save energy, reduce maintenance and increase overall throughput and production quality. Before an improvement plan can be realized, the overall need of compressed air should be established. From there, parameters such as air quality, air quantity, system pressure and load requirements can be documented. This can take place via diagram and process description method, but should be properly followed up with a base lining and benchmarking program (see Figure 6).

The goal is not to re-invent your system; the measurable tasks are to isolate leaks, determine production-dependent and independent requirements and evaluate system pressure. Once these values are in place, energy use and costs can be calculated. At that point, we can attack the largest "unnecessary" costs first. It will come as no surprise these are typically leaks. Leakage accounts for an astonishing 30% of the air generated (see Figure 7).

Combining better measurement and advanced data acquisition, the power lies in your hands to improve efficiency and energy management at your site!

Table 1 Energy saving opportunities for a typical industrial compressed air system[1]

	Potential savings[2]	Investment[3]
Management Actions		
Raise the awareness of all users to the proper use of compressed air	10-15%	Low
Develop and implement a maintenance programme for the whole system	5-8%	Low
Install metering and implement monitoring	5-10%	Medium
Use only trained and competent personnel for installation, servicing and system upgrades	5-10%	Low
Develop and implement a purchasing policy	3-5%	Low
Technical Actions		
Implement a leak reporting and repair programme	20-40%	Low
Do not pressurise the system during non-productive periods	2-10%	Low
Fit dryer controls (refrigerant and desiccant)	5-20%	Medium
Install compressor drive and system control measures	5-15%	Medium
Install heat recovery measures where appropriate	Up to 75%	Medium

[1] Operating at 7 bar(g) (700kPa(g)) with an output of 500 litres/s
[2] The percentage figures given are indicative, are not cumulative and will vary with each system
[3] Low = less than £2,000; Medium = £2,000–£10,000

Figure 6. Represents a theoretical overview of a compressed air system and the areas of associated cost reduction opportunities. Source: The Carbon Trust (2005): GPG385 Energy Efficient Compressed AirSystems, London.

Leakage rates[a] (cfm) for different supply pressures and approximately equivalent orifice sizes[b]						
Pressure (psig)	Orifice Diameter (inches)					
	1/64	1/32	1/16	1/8	1/4	3/8
70	0.29	1.16	4.66	18.62	74.4	167.8
80	0.32	1.26	5.24	20.76	83.1	187.2
90	0.36	1.46	5.72	23.1	92	206.6
100	0.40	1.55	6.31	25.22	100.0	227
125	0.40	1.94	7.00	30.65	122.2	275.5

Figure 7. Represents the leakage rage vs. hole size at 100 psig for a 200 kW compressor. Source: US DOE Industrial Technology Program Tip Sheet for Compressed Air #3.

IT PAYS TO GIVE ENERGY MANAGEMENT A THOUGHT!

Depending on its use, a properly maintained and monitored compressed air system can save energy, reduce maintenance and increase overall throughput and production quality.

Compressed Air Leak Management Example:

- 10 leaks of ¼" at 100 psig.
- Assume 7,000 annual operating hours, an aggregate electric rate of $0.05 kWh and compressed air generation requirement of approximately 18 k/100 cfm
- Cost savings = # of leaks x leakage rate (cfm) x kW/cfm x # of hours x $/kWh. Using values of the leakage rates from Figure 7 and assuming sharp-edged orifices:
- Cost savings from ¼" leaks = 10 x 100.9 x 0.61 x 0.18 x 7,000 x 0.05 = $38,776. Total cost savings from eliminating these leaks = $57,069. Note that the savings from the elimination of just 10 leaks of ¼" account for almost 70% of the overall savings vs. smaller orifices and leaks total in the system
- Cost of a simple pressure transducer with 4-20mA loop output, direct wire into PLC with no display <$250. With the potential to save $57,000/year, how many holes can you find with $200 pressure transmitters?

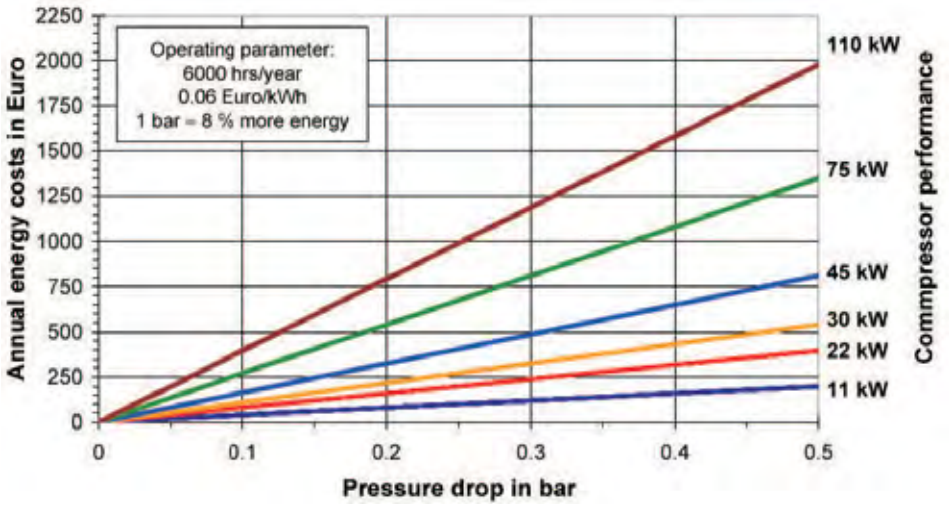


Figure 8. Represents a typical installation of low-cost gauge pressure transmitters, a differential math module across a filter. The math module is programmed for maximum allowable differential pressure vs. cost of filter vs. cost of electricity to overcome fouling. Filter courtesy of Koch. Statistic for pressure loss vs. electricity courtesy of US DOE Save Energy Now Industrial Program for Air Systems.

Another area of fast return is monitoring dirty and clogged filters. An unchanged filter creating undesirable pressure loss is costing you money every hour it runs. In fact, it may even require the use of additional compressors to maintain requisite system pressure. As a general rule of thumb, it is noted that a pressure drop of 2 psi will reduce the air capacity by 1%. When that differential pressure loss is doubled to 4 psi, you can expect to see a 2% increase to your air system energy costs. Filter differential pressure not only leads to losses, but is further compounded by moisture and condensate in the air system. Opening or actuating traps to relieve condensate too often leads to increases in the system's overall demand for air (see Figure 8).

A final common application that yields big savings with installed measurements in compressed air systems is that of isolating and identifying load requirements. The goal is to ultimately differentiate between production-dependent and independent air requirements (see Figure 9). For example, a simple way to analyze the system would be to ask, "Why does that part of my system have air running to it when it's not in use?" A second strategy would be to analyze the air requirement in sub-systems when devices are not in use vs. those times when requirements are high. In this manner, production-dependent vs. independent air can be identified vs. the rating on the individual consumers (see Figure 10A/B). This serves multiple purposes. First, leaks can be further identified if a machine is not in use but is drawing air. Second, air demand vs. actual system requirements can determine air quality in so far as moisture, out-of-specification filters and misuse of machinery.

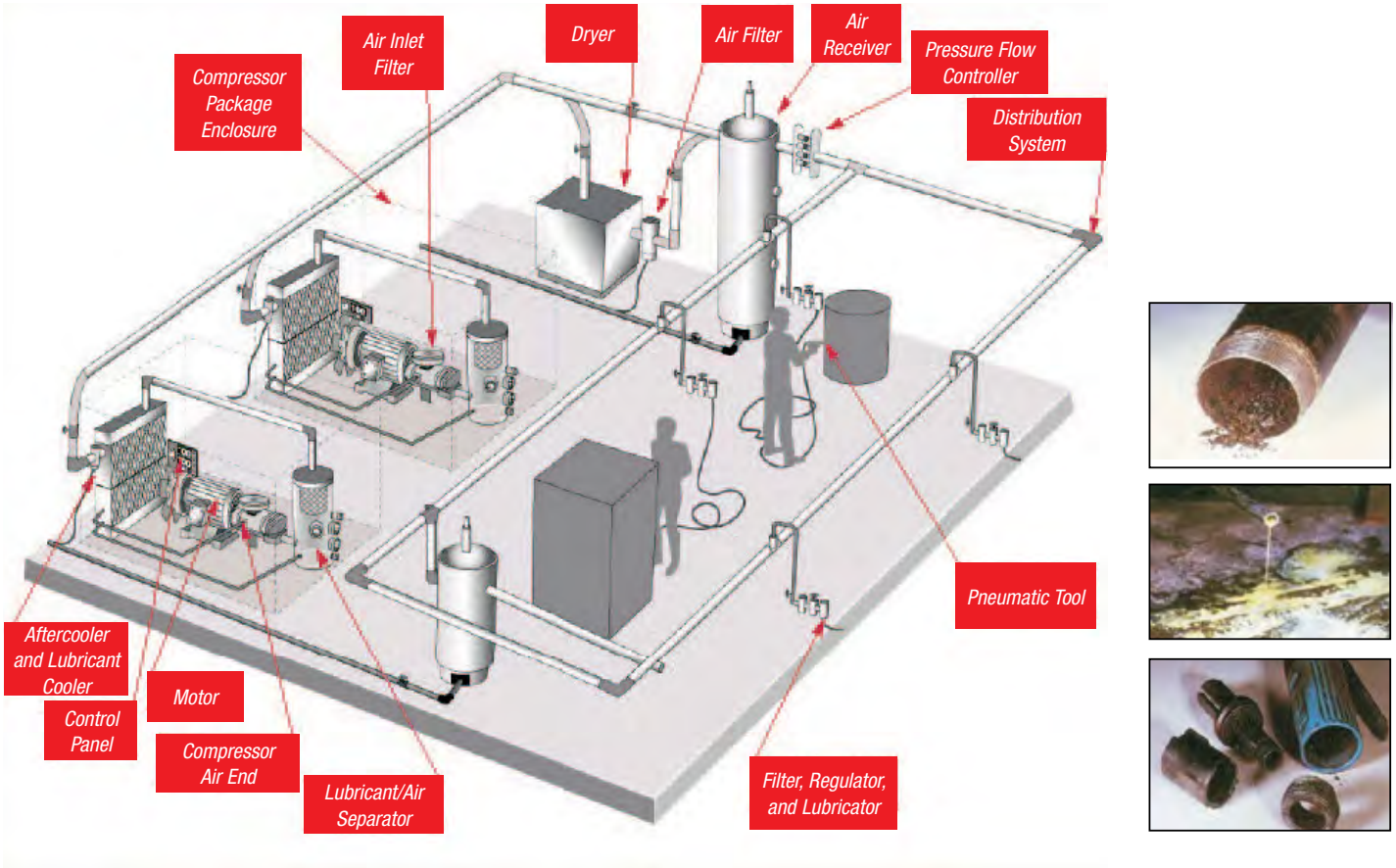


Figure 9. Represents a factory air system. A typical system consists of compressor(s), controls and regulators, dryer, receiver, ring main and individual users. The photographs on the right indicate corrosion and build-up from improper filter maintenance, costly and corrosive condensation from a poorly maintained dryer, and damaged tools and fittings, all of which can lead to unscheduled maintenance increased costs and inefficiencies. Source: www.energymanagertraining.com/equipment_all/compressors/1.htm

IT PAYS TO GIVE ENERGY MANAGEMENT A THOUGHT!

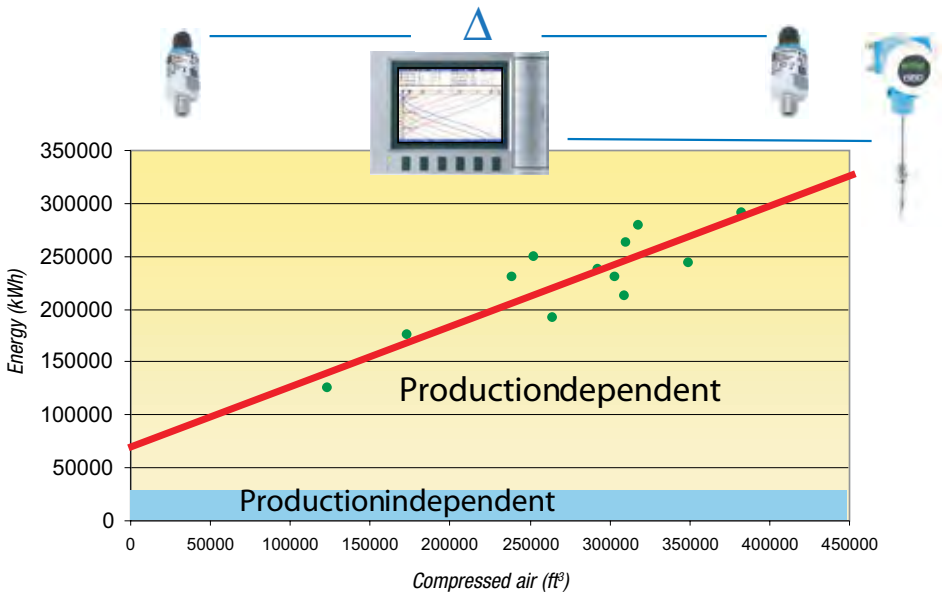
Compressor Heat Recovery

90% of the electric energy is lost as heat in a compressor. Generally speaking, a colder compressor will deliver more air. Thus, if you can install a heat recovery system around your compressor and re-use the waste heat, you not only reduce the heating costs for your plant, you also gain in compressor efficiency.

Summary

The ubiquitous air systems hissing at your plants can be a source of some real savings. Some experts estimate the possible electricity savings to be anywhere from 5–30%. This can be a relief to your monthly cash flow and a long-term boost to your bottom-line. The question is, when can you start? BP

For more information please contact Jerry Spindler, Endress + Hauser, tel: 317-535-2106, email: jerry.spindler@us.endress.com, www.us.endress.com.



Evaluate performance, identify leakage and benchmark findings
Lower the production-independent requirement by isolating leaks and idle machines that are not in use
Two pressure measurements, a thermal mass and a benchmarking recorder with math cost less than $7,000.
Potential savings @5 cents/kWh for a 200 kW compressor running five days per week is $16,000 a year

Figure 10A. Example of Compressed Air System benchmarking survey to determine production-dependent vs. independent air requirements, isolating leaks and isolating users from the system when machines are idle.

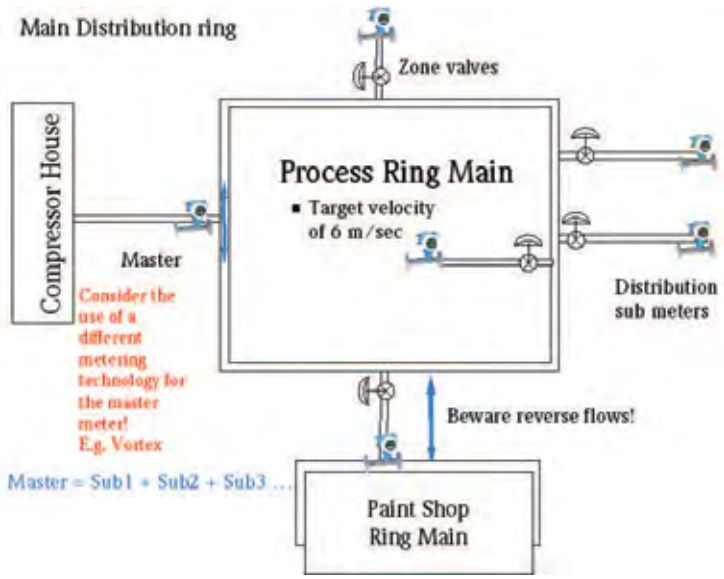


Figure 10B. Where to measure? Some examples

The 2009 NAACD Conference & Exhibition

BY COMPRESSED AIR BEST PRACTICES®

The CompAir/Champion team. Pictured are Bryan Fasano, Vinson Sill, Bill Steele, Schyler Engel, Joe Henke and Rob Phillips (left to right)

Joshua Wamser (RWI Industrial) and Vinson Sill (CompAir/Champion) review the new Champion Evolution 5 hp, 67 dba, air-cooled air compressor featuring a magnetic starter

The 2009 North American Association of Compressor Distributors (NAACD) Conference and Exhibition was held October 4–6 in Hilton Head Island, South Carolina. A strong turnout of air compressor distributors and exhibitors enjoyed the southern hospitality and focused on the theme "Beating Your Competitors with Superior Technology."

Since Gardner Denver's acquisition of CompAir late last year, there have been many changes to the NAACD membership. "One of the more positive changes for the NAACD is that some of the larger Champion distributors attended the convention this year," said NAACD President, **Mr. Shaun Orr** of Compressed Air Systems, Inc.

CompAir & Champion Compressors

The anchor exhibitor and NAACD partner was CompAir and Champion Compressors. The one thing that all NAACD members have in common is that they all represent CompAir and/or Champion products and services. CompAir sent strong management representation to the show, including Gardner Denver CEO Barry Pennypacker. Distributors reported that they were excited to hear Mr. Pennypacker outline Gardner Denver's plan to support and grow the CompAir and Champion brands.

CompAir/Champion National Sales Manager **Bill Steele** had a broad range of technologies to show NAACD members: Hydrovane rotary vane air compressors, Champion oil-less and tank-mounted reciprocating air compressors with magnetic starters and CompAir oil-free and lubricated rotary screw air compressors.

The CompAir L Series rotary screw compressor got a lot of attention. The product features an integrated airend, which operates at low rotational speeds and provides a small package footprint. The units come standard with high-efficiency TEFC motors and Wye/Delta starters. The L Series 20–30 hp belt-drive packages I looked at had dba ratings of 73–74 and a sleek microprocessor control system. They also had up to 113 °F ambient capability.

THE 2009 NAACD CONFERENCE & EXHIBITION

BEKO's Regional Sales Managers Jim Hughes and Scott Woodward (left to right) displayed the new METPOINT range of instruments

Doug Barhorst (Air Handling Equipment) and Sharon and Dave Anderson (Thermotech) review the heat recovery units

Pat Weins (CompAir Service Co.), Steve Jiroutek (Vaisala) and Bruce Davis (CompAir Service Co.) review Vaisala's hand-held dew point monitors and transmitters

Measurement Products

As usual, the exhibitions included multiple brands of compressed air dryers, filters, intake air filters, compressor control systems and air/oil separators. The NAACD members do a good job of visiting every booth and really getting to know the equipment vendor and the new technologies on display. What is certainly a growing trend is the display of instrumentation products.

The BEKO Technologies booth really jumped out at me. What caught my attention was their complete offering of METPOINT control devices for compressed air systems. The METPOINT range provides a compressed air technology provider with all of the instruments needed to measure a compressed air system. The BEKO METPOINT products included DPM polymer-sensor pressure dew point monitors, FLM thermal mass flow sensors and LKD ultrasound leak detectors. They also displayed a convenient PRO package that allows up to six sensors to connect into a multi-function display. I personally believe that downstream measurement and management is an area of great opportunity (and need) in compressed air systems.

Vaisala had their DRYCAP hand-held dew point meters on display. Vaisala also offers a family of fixed-mount dew point transmitters to permit the communication of measurements. UE Systems displayed their Ultraprobe 3000 ultrasonic leak detector — a unit designed specifically for compressed air systems. UE has a full range of inspection systems, all the way up to the Ultraprobe 10,000, which can record and analyze sound samples, perform condition analysis, store test data, trend results and generally manage the test data. COSA Instruments was also present and displayed a professional line of flow meters and dew point meters.

Thermotech displayed a hot water recovery system, featuring a double-wall heat exchanger with three different heat recovery models for 100 hp, 200 hp and 300 hp air compressors. JORC displayed their no air-loss drains and condensate management products. BELAIR displayed their full range of dryers, and Clean Resources displayed their CRP Paks oil-water separators.

Conclusion

My apologies to those exhibitors not mentioned here due to space considerations. The overall atmosphere of the NAACD Convention continued to be the same friendly yet professional atmosphere we have grown to expect. The new technologies on display made this NAACD very interesting. BP

RESOURCES FOR ENERGY ENGINEERS

TRAINING CALENDAR

TITLE	SPONSOR(S)	LOCATION	DATE	INFORMATION
Compressed Air Challenge® Fundamentals of Compressed Air	Ind. Efficiency Alliance Pacific Power Energy Trust of Oregon Bonneville Power	Bend, OR	11/12/09	Training Center Tel: 888-720-6823 TrainingCenter@industrialefficiencyalliance.org www.compressedairchallenge.org

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

INDUSTRY NEWS

ALMiG Distributor Meeting

The visiting director of marketing from Germany, Mr. Reiner Haja, kicked off the ALMiG distributor meeting by saying, "The answer is yes, now please ask your questions!" His tone pretty much sums up the overall positive atmosphere of the event, held in September 2009 in Green Bay, Wisconsin.

ALMiG USA General Manager John Raymond welcomed distributors from California, Texas, Alabama, Canada, New York and a number of other locations. Everyone came to see the inventory and new technologies that were on display and ready to ship. The attendees were split into two groups, each of which spent a half-day with hands-on technical training in the warehouse with the machines and in a sales training classroom.

ALMiG Kompressoren was started in July 2007 with a management buyout of the ALUP product designs and manufacturing facility. The company now has 280 employees and recently purchased a second plant to handle the growing sales volume.

Distributor meeting presentations communicated three main advantages of ALMiG products. Namely, their products:

1. Are simple to work on and perform preventative maintenance
2. Provide superior variable frequency drive
3. Are available in a broad product range

ALMiG USA
Tel: 920-593-4822
www.almig.us

Scott Tremble, Paul Steinbach and John Raymond of ALMiG USA

Daniel Fritz and John Raymond with the ALMiG COMBI

RESOURCES FOR ENERGY ENGINEERS

INDUSTRY NEWS

ZEKS Celebrates 50th Anniversary

ZEKS Compressed Air Solutions
Tel: 610-692-9100
www.zeks.com

For employees at ZEKS Compressed Air Solutions in West Chester, Pennsylvania, 2009 represents the organization's 50th year as a manufacturer of exceptional compressed air treatment equipment. Recently, a special lunch was held at the facility to commemorate the occasion. On-hand to celebrate with the manufacturing and office personnel were several retired employees who had been with the company in the early years.

In 1959, ZEKS introduced the world's first cycling refrigerated air dryer, which has remained the standard by which others are measured. Throughout its 50-year history, ZEKS has developed innovations that help minimize the cost of air treatment, while maximizing reliability in air systems from 10–19,200 scfm. Among them is the corrugated, folded stainless steel heat exchanger that adds efficiency and durability to ZEKS refrigerated dryers.

PRODUCT PICKS

Redesigned Two-Stage Compressor

Sullair Corporation announced the redesign of their 100–600 hp Two-Stage (TS) Tandem Rotary Screw Compressors. The TS Series tandem compressors offer unmatched full load efficiency, often providing a two-year payback in energy savings when compared to single-stage compressors. With the tandem's variable capacity control, featuring spiral valve technology, further operating efficiencies can be achieved during part load operation.

Redesigned to provide increased levels of energy efficiency and operating performance, these versatile compressors offer a choice of either constant speed drive models TS-20, TS-32 and TS-32S, with capacities of 500–3000 acfm, or Variable Speed Drive (VSD) models like the V-200TS and V-320TS, which have a capacity range of 495–2310 acfm. Pressures for all Sullair two-stage tandem models range from 100–175 psig. The Sullair tandem compressor with an optional heat recovery enclosure saves more energy by recovering expended heat from a compressor that can be used for supplemental comfort heating or as make-up air for process heating.

The Sullair two-stage compressors also feature the most advanced upgrade of Sullair's Supervisor™ Controller, a computer-compatible microprocessor control unit that provides critical operating information using simple graphics of monitored functions and easy-to-use stop/start, sequencing and activation controls.

Variable capacity control, achieved with Sullair's spiral valve technology, enables the compressor to match pressure and capacity with system demand. At full load, the tandem compressor and spiral valve have proven to be 13% more energy efficient. At 60% load, the Sullair two-stage tandem compressors provide up to a 30% savings over single-stage compressors. Additional part load and full load energy savings are achieved with optional Variable Speed Drive (VSD), which provides the highest power factor over the entire frequency range. This package, combined with the spiral valve, offers the best control with the lowest turndown in the industry — truly the ultimate energy savings in compressed air systems.

Sullair Corporation
Tel: 219-861-5089
email judi.seal@sullair.com, www.sullair.com

PRODUCT PICKS

New Cycling Dryer

Hankison, an SPX brand, announced the January 2010 release of their new HES Energy Saving Refrigerated Compressed Air Dryers, ideal for flows from 90–675 scfm. The HES Series delivers the total package in air treatment. Precision-engineered heat exchangers, ISO Quality Class integrated filtration and rugged refrigerant compressors make the Hankison Energy Savings (HES) Series the sustainable solution for compressed air systems with variable air load demand!

SPX Hankison
Tel: 352-237-1220
email: jay.francis@spx.com
www.hankisonintl.com

$mart Sequencer®

Scales Industrial Technologies presents the $mart Sequencer® intelligent compressor control system. The system is designed to reduce plant energy costs by continuously monitoring system demand and automatically selecting the most energy efficient combination of available air compressors.

Scales Industrial Technologies
Tel: 866-248-9096
www.scalesindtech.com

New GA 5–11 kW Variable Speed Drive Compressor

Atlas Copco announced the introduction of its redesigned small, oil-injected screw compressor range — the GA 5–11/GA 5–15 kW Variable Speed Drive (VSD). Through an 8% increase in free air delivery (FAD), noise levels as low as 60 decibels, new VSD voltage variants and an extended operating range, the GA 5–11/GA 5–15 kW VSD range sets new industry standards in performance, flexibility and reliability.

Atlas Copco
www.atlascopco.us

New 2-in-1 Compressor

Kaeser announces the new 2-in-1 HSD Compressor. It is the first of its kind, featuring *two independently operating compressors* in a single enclosure. These new packages are available from 500–650 hp, and deliver flows from 1632–3002 cfm and pressures from 100–217 psig.

Each HSD incorporates two individual compressor units, including a motor, Sigma Profile airend, separator aftercooler, draintrap and filtration system. Because each module is a complete compressor (and not just two airends stacked together) the HSD provides maximum part load efficiency, built-in redundancy and reduced installation costs.

HSD compressor units are started one after another to reduce inrush current and protect against network overload. Both compressor units have dedicated Sigma Controls connected via Profibus for energy efficient sequencing and fully automatic monitoring of critical operating and maintenance indicators. Plus, with the Sigma Frequency Control option, the HSD is not only the largest variable frequency drive in its class, but it also doubles the flow range of previous models.

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

New Infrared Cameras

FLIR Systems announces the addition of the new FLIR T300 and B300 thermal imaging cameras. The new models capture detailed, crisp images and video with a 320x240 focal plane array (FPA) detector (76,800 pixels). FLIR's affordable T300 and B300 tackle the performance demands of industrial, plant, utility, HVAC and building related professionals.

FLIR
Tel: 800-GO-INFRA
http://go.flir.com/t300info

RESOURCES FOR ENERGY ENGINEERS

LITERATURE & SERVICES PICKS

Gardner Denver, Inc.: 150 Years of Industrial Innovation

Issued for year 2009 by Gardner Denver, Inc.

Gardner Denver, Inc.: 150 Years of Industrial Innovation

Illinois — The Donning Company Publishers is pleased to announce the release of a new volume in the history of manufacturing: *Gardner Denver, Inc: 150 Years of Industrial Innovation*, which details the rich history of the company.

Robert Gardner began his stellar career in his hometown of Quincy, Illinois, in 1858, the time of the Lincoln-Douglas debate. He started the company in the infancy of the Industrial Revolution. The company has since weathered world wars, economic depressions and natural disasters. Gardner Denver's global position in the market it serves is stronger than ever, thanks to generations of dedicated employees and the innovative spirit that continues to provide superior solutions to customers' industrial needs. As each page is turned, you will follow the growth of not only the company, but of the people and the local and global community.

Gardner Denver, Inc: 150 Years of Industrial Innovation is now available.

Follow Gardner Denver's impact on the world and the world's impact on Gardner Denver.

Copies of this 128-page hardcover book can be ordered for $25.00 through the online bookseller Amazon.com (www.amazon.com).

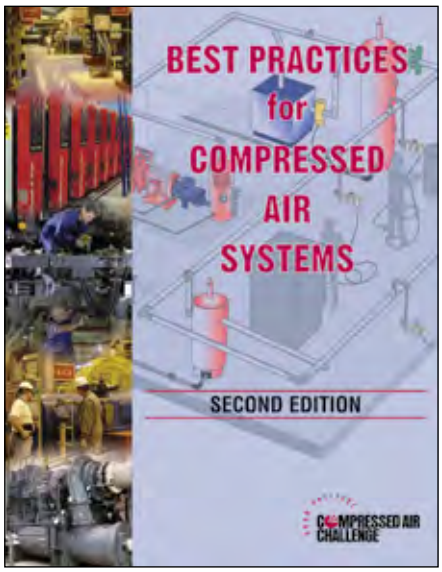
New Edition of "Best Practices for Compressed Air Systems®" from the Compressed Air Challenge®

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

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

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

Compressed Air Challenge®
www.compressedairchallenge.org



WALL STREET WATCH

BY COMPRESSED AIR BEST PRACTICES®

The intent of this column is to provide industry watchers with publicly held information, on publicly held companies, involved with the sub-industry of compressed air. It is not the intent of the column to provide any opinions or recommendations related to stock valuations. All information for this column was gathered on November 2, 2009.

NOVEMBER 2, 2009 PRICE PERFORMANCE	SYMBOL	OPEN PRICE	1 MONTH	6 MONTHS	12 MONTHS	DIVIDEND (ANNUAL YIELD)
Parker-Hannifin	PH	$52.96	$49.62	$46.18	$38.71	1.89%
Ingersoll Rand	IR	$31.59	$29.36	$21.80	$18.42	1.58%
Gardner Denver	GDI	$35.91	$32.46	$27.24	$25.51	—
United Technologies	UTX	$61.45	$59.38	$49.62	$54.96	2.48%
Donaldson	DCI	$35.67	$33.05	$33.07	$35.13	1.29%
EnPro Industries	NPO	$22.58	$21.71	$15.61	$22.19	-----
SPX Corp	SPW	$52.78	$57.19	$46.71	$38.53	1.89%

UTC Posts 3rd Quarter Results

HARTFORD, Conn. — United Technologies Corp. (NYSE:UTX) today reported third quarter 2009 earnings per share of $1.14 and net income attributable to common shareowners of $1.1 billion, down 14% and 17%, respectively, over the same year ago quarter. Results for the current quarter include $0.13 per share in restructuring costs net of one-time gains, as compared with $0.03 in the year ago quarter. Before these items, earnings per share declined 7%. Adverse foreign currency translation and currency hedges at Pratt & Whitney Canada totaled $0.07 per share in the third quarter of 2009.

Revenues for the quarter at $13.4 billion were 11% below prior year, including organic decline (7 points) and adverse foreign currency translation (3 points). Segment operating margin at 14.5% was 20 basis points higher than the prior year. Adjusted for restructuring costs and one-time gains, the segment-operating margin was 70 basis points higher than the prior year. Cash flow from operations was $1.9 billion, including $150 million of domestic pension contributions. Capital expenditures were $161 million in the quarter.

WALL STREET WATCH

"As Ingersoll Rand continues to drive towards world-class productivity performance and deliver ongoing benefits from the integration of our businesses, it is imperative that we accelerate our progress in achieving continuous improvement and greater efficiencies across our operations."

— Michael W. Lamach, president and chief operating officer at Ingersoll Rand

"Strong execution and our relentless focus on cost contributed to a record segment operating margin, even in the face of tough end markets," said Louis Chênevert, UTC president and chief executive officer. "Cash flow from operations less capital expenditures was 160% of net income attributable to common shareowners on significant inventory reductions across both commercial and aerospace businesses."

"Year over year order rates have substantially stabilized, although at lower levels, and we've started to see improvement in some Asian economies, notably China," Chênevert continued. "Based on overall order trends, as well as significant cost traction, we now expect 2009 earnings per share at $4.10, the midpoint of the prior range of $4.00 to $4.20. This guidance also reflects higher restructuring of $800 million this year with one-time gains of around $175 million, compared with $750 million of restructuring and $200 million of gains assumed earlier."

"Cash flow from operations less capital expenditures year to date is 123% of net income attributable to common shareowners, notwithstanding $551 million of domestic pension contributions," Chênevert said. "Working capital and inventory reductions are enabling this, and we are confident this cash flow metric will again exceed UTC's usual standard of 100% for the year."

Chênevert added, "Order rates for most of our businesses have largely stabilized, although the shape of recovery is still uncertain. What is certain is the cost traction across UTC. In addition, the portfolio transformation at Carrier, a strong military backlog and significant aftermarket content in all our businesses position us to resume earnings growth in 2010."

IR Announces 3rd Quarter Results

Swords, Ireland, October 20, 2009 — Ingersoll-Rand plc (NYSE:IR) today announced the appointment of Todd Wyman as senior vice president, Global Operations and Integrated Supply Chain, effective November 16, 2009. He will report to Michael W. Lamach, president and chief operating officer, and be based in Davidson, North Carolina. Wyman also will be recommended to the Board of Directors for election as an officer. He will be a member of the company's Enterprise Leadership Team.

Wyman joins Ingersoll Rand from General Electric (GE), where he was an elected officer and vice president of Global Supply Chain for GE Transportation, responsible for global manufacturing, sourcing and distribution. Prior to that, he was general manager, Global Supply Chain for GE Transportation. Wyman joined GE's Manufacturing Management Program in 1989, and progressed to increasingly more responsible roles in operations, sourcing and general management across several GE businesses, including Power Systems, Electrical Distribution & Controls and Industrial Systems. Wyman holds a bachelor's degree in Management Engineering from Worcester Polytechnic Institute, Worcester, Massachusetts.

"As Ingersoll Rand continues to drive towards world-class productivity performance and deliver ongoing benefits from the integration of our businesses, it is imperative that we accelerate our progress in achieving continuous improvement and greater efficiencies across our operations," said Michael W. Lamach, president and chief operating officer at Ingersoll Rand. "With tremendous experience and demonstrated success across all facets of operations management, Todd is well prepared for this critical leadership role and duties that include the development and implementation of long-range strategies to optimize manufacturing operations, develop and leverage a globally integrated supply chain and transform the ways in which the company applies assets across the enterprise."

Ingersoll Rand is a global, diversified industrial firm providing products, services and solutions to enhance the quality and comfort of air in homes and buildings, transport and protect food and perishables, secure homes and commercial properties and enhance industrial productivity and efficiency. Driven by a 100-year-old tradition of technological innovation, we enable companies and their customers to create progress. For more information, visit **www.ingersollrand.com**. BP

COMPRESSED AIR BEST PRACTICES®
www.airbestpractices.com

ADVERTISER INDEX

Company	Page	Web Site
Kaeser Compressor	Outside Back Cover	www.kaeser.com
World Energy Engineering Congress	Inside Back Cover	www.energycongress.com
Atlas Copco	Inside Front Cover	www.atlascopco.com
Hitachi	3	www.hitachi.us/airtech
SPX Hankison	5	www.hankisonintl.com
Mikropor America	6	www.mikroporamerica.com
CDI Meters	7	www.cdimeters.com
Chicago Pneumatic	9	www.cp.com
ALMiG USA	11	www.almig.us
JORC Industrial	13	www.jorc.com
SIGA Airleader	15	www.airleader.us
FS-Elliott	17	www.fs-elliott.com
Parker domnick hunter	21	www.domnickhunter.com
Awareness Ideas	31	www.awarenessideas.com

COMPRESSED AIR BEST PRACTICES®
www.airbestpractices.com

Advertising & Editorial: Rod Smith
rod@airbestpractices.com
Tel: 251-680-9154

Subscriptions & Administration: Patricia Smith
patricia@airbestpractices.com
Tel: 251-510-2598
Fax: 412-831-3091

A Publication of: Smith Onandia Communications L.L.C.
217 Deer Meadow Drive
Pittsburgh, PA 15241

Compressed Air Best Practices® is published monthly by Smith Onandia Communications LLC., 217 Deer Meadow Drive, Pittsburgh, PA 15241. Phone 251-510-2598, Fax 412-831-3091, email patricia@airbestpractices.com. Compressed Air Best Practices® is a trademark of Smith Onandia Communications, LLC. Publisher cannot be held liable for non-delivery due to circumstances beyond its control. No refunds. Standard postage is paid at 233 Jefferson Street, Greenfield, Ohio 45123. Canadian and international distribution: IMEX International Mail Express, 1842 Brummel Drive, Elk Grove Village, IL 60007. POSTMASTER: Send address changes to Compressed Air Best Practices,® 217 Deer Meadow Drive, Pittsburgh, PA 15241. SUBSCRIPTIONS: Qualified reader subscriptions are accepted from compressed air professionals, plant managers, plant engineers, service and maintenance managers, operations managers, auditors, and energy engineers in manufacturing plants and engineering/consulting firms in the U.S. To apply for qualified reader subscriptions, please fill in the reader response cards herein and mail or fax or go to www.airbestpractices.com. To non-qualified subscribers subscriptions are $65 in Canada and $95 for other countries. When available, extra copies of back issues are $4 plus shipping. Contact Patricia Smith for subscription information at tel: 251-510-2598 or email: patricia@airbestpractices.com. REPRINTS: Reprints are available on a custom basis, contact Patricia Smith for a price quotation at tel: 251-510-2598 or email: patricia@airbestpractices.com.

THE MARKETPLACE

TECHNOLOGY

www.s2000wireless.com
(800) 643-1339
seanh@s2000wireless.com
S2000 Service Software LLC

ATLAS MACHINE & SUPPLY, INC.

Atlas Machine & Supply, Inc., a 102-year-old compressed air distributor, seeks qualified personnel for the following positions:

1. **Business Development Manager** — Pump Division, Louisville, KY
2. **Industrial Sales Representative** — Compressed Air Division, Dayton, OH
3. **Technical Parts Advisor** — Compressed Air Division, Louisville, KY

Please visit **www.atlasmachine.com** for more details.

airleader Compressor Management

We are currently looking for Sales Professionals, please contact us.
www.airleader.us

Contact Rod Smith for ad rates:

rod@airbestpractices.com, tel: 251-680-9154

COMPRESSED AIR BEST PRACTICES®
THE MARKETPLACE ADVERTISING RATES

MAGAZINE ADS

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

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

*reversed ads = 1.5x normal price

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

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

rod@airbestpractices.com, tel: 251-680-9154

World Energy Engineering Congress returns to nation's capital in 2009!

WEEC 2009
WORLD ENERGY ENGINEERING CONGRESS

Presented by
AEE The Association of Energy Engineers

Hosted by
SAIC From Science to Solutions

November 4-6, 2009 • Washington Convention Center • Washington, DC • www.energycongress.com

Keynote Speaker

Robert F. Kennedy, Jr.
Sustainable Energy & the Environment

The key opportunity of the year for end users and decision-makers from business, industry, and government sectors to learn about the newest technologies, hear industry's leading experts, and network

Featuring Green Street EXPO at WEEC Sponsored By

LEARN MORE AT energystar.gov

The Association of Energy Engineers (AEE) is pleased to bring the World Energy Engineering Congress (WEEC) back to Washington, DC for 2009. In its 32nd year, the World Energy Engineering Congress is one of the most important energy events of national & international scope for end users and energy professionals in all areas of the energy field. Sponsored by the Association of Energy Engineers (AEE), the conference promises a forum illustrating where economic and market forces, new technologies, regulatory developments and industry trends merge to shape an organization's energy and economic future.

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

Energy, Sustainability, Green Collar Jobs, Smart Grid, Federal Initiatives Hot Topics for 2009

The WEEC conference and exposition target market's most promising new technologies and services, including such topics as:

- *Energy Management*
- *Integrated Building Automation*
- *Combined Heat & Power*
- *Cogeneration / Distributed Generation*
- *Lighting Efficiency*
- *Energy Auditing*
- *Industrial Energy Strategies*
- *LEED*
- *Fortune 500 Showcase*
- *Green Collar Economy*
- *Green & Sustainable Initiatives*
- *Geoexchange Technologies*
- *Renewable & Alternative Energy*
- *Federal Energy Management*
- *HVAC Systems & Controls*
- *Energy Services and Project Financing*
- *Energy Policy Regulatory Changes*
- *Solar & Fuel Cell Technologies*
- *Smart Grid*
- *Carbon Reduction*

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

WEEC 2009 Highlights!

- *Legends in Energy Gala*
- *U.S. EPA, Energy Star Industry Focus Meetings*
- *Council on Woman in Energy & Environmental Leadership*
- *AEE Industry Awards Banquet*
- *Save Energy Now Awards*
- *New Technologies Breakfast*
- *Conference with over 250 speakers*
- *Certification Programs & Seminars*
- *AEE Foundation Scholarship Fundraiser*
- *WEEC & GreenStreet Expo*
- *Free Workshops*
- *Keynote Luncheon*

Government Energy Leaders

Department of Defense

GAO Accountability • Integrity • Reliability

NTIS U.S. Department of Commerce National Technical Information Services

Platinum Sponsor

LEARN MORE AT energystar.gov

Bronze Sponsor

North America Power Partners LLC THE ENERGY DEMAND RESPONSE RESOURCE

White Star Energy Leader

Utility Management Services, Inc. Your Utility Rate Specialists

Red Star Energy Leaders

Raytheon

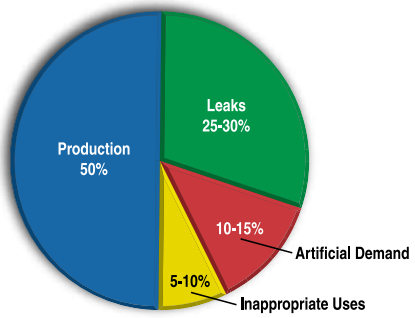
FPL

At Kaeser, our tradition of saving energy goes back generations.

Energy costs have never been higher. That's why it's so important to get maximum efficiency out of your compressed air system. And with as much as 50%* of compressed air being wasted, you could save a bundle.

Trust the specialists at Kaeser to find energy savings by reducing inefficiency in your air system, while also cutting maintenance costs and delivering process improvements. We are the industry leader in conducting *true, comprehensive* air system audits, so you know you'll get the best possible advice and recommendations.

Visit **www.kaeser.com/ada** to see if you'll benefit from an Air Demand Analysis (ADA) - and how we've helped other plants significantly improve their bottom line.



*Only 50% of compressed air is actually put to productive use.**

KAESER COMPRESSORS

Built for a lifetime.™

www.kaeser.com/ada