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FOCUS INDUSTRY FEATURES

Oil Refinery Rental Air | 13
By Compressed Air Best Practices

**Compressed Air as a Hole-Cleaning
Fluid in Rotary Air Drilling** | 20
By Hank Van Ormer

**Rotary Air Drilling — Sizing
the Compressed Air Supply** | 23
By Hank Van Ormer



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COMPRESSED AIR INDUSTRY ARTICLES

From the Editor	8
Wall Street Watch	9
McKenzie Equipment	28
Atlas Copco & Tide Air	34
Maintenance: Industry's Most Understated Asset By Roy Jones	38
Industry News	44
Job Market	50



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FROM THE EDITOR

Energy Independence

Energy independence is a topic of tremendous importance today in the United States. The war in Iraq has created an unprecedented desire, by the U.S. voter, to not have to buy oil from

"over there". The voter

has forced a political change and with it a renewed determination, by both government and corporations, to invest in becoming energy independent.

Replacing foreign oil with domestically-produced oil is one option. I have listened to powerful U.S. Senators, from both sides of the aisle, foresee greater energy independence by opening up the Gulf Coast, Alaska, and the Atlantic Coast, for safe oil exploration. A major benefit cited is the creation of jobs, in an expanded U.S.-based, oil-exploration industry. U.S. manufacturers of drilling-related equipment (including air compressors and dryers) would also clearly benefit. Environmentalists, however, are quick to cite the potential dangers to the environment, should accidents occur. There is no denying that environmental risk-levels would be raised. The question is whether the risk is worth the reward. In this month's edition, we have articles on the role of compressed air in oil drilling and refining. Included is an article from **Mr. Hank Van Ormer**, who provides a handy guide on calculating the compressed air requirements of a drilling rig.

Simply reducing the consumption of energy, in the U.S., is what lean management people would call "the root cause" of the problem. This is where tremendous business opportunities exist. Opportunities for environmental and business "Win/Win" scenarios have never been greater. **Compressed Air Best Practices Magazine** makes a concerted effort to document these "Win/Win" scenarios in our pages.

I salute the industry leaders, who are making investments (and accepting the risks) into renewable energies. Clearly there are corporations deciding that profits can be increased (and stock prices), with long-term strategies which are also positive for the environment. The Chairman and CEO of **United Technologies Corporation**, **Mr. George David**, made the following remarks, in March 2006, at the World Business Council for Sustainable Development,

"The proposed ultimate project goal is buildings which are energy self-sufficient, zero CO₂ emissions, and commercially viable by 2050. This will be a tall order indeed, and we may not get there. But I learned a long time ago that big goals get big results, and more certainly that small goals will get small ones."

UTC sponsors a Sustainable Cities Initiative which hosts events, such as one in June 2006, called "The Green Homes for Healthy Families Symposium". At this event, an official from the Carrier Division of UTC said, "Buildings consume 40% of all energy and 68% of all electricity in the U.S. Over the past ten years, we Americans have increased our electricity use by 22%. House by house, we can reverse this trend". The same official pointed out that, although Carrier has more than doubled in size since 1997, energy use has remained flat. Walker Wells, the program director at Global Green USA elaborated, "Buildings account for 30% of U.S. carbon dioxide production and 25% of water use".

Independence, of any kind, has never come without risks. Energy independence is a risk worth taking.

ROD SMITH

"Opportunities for environmental and business 'Win/Win' scenarios have never been greater."

COMPRESSED AIR BEST
PRACTICES MAGAZINE

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A Publication of: Smith Onandia
Communications L.L.C.
161 Clubhouse Circle
Fairhope, AL 36532

Compressed Air Best Practices is published monthly by Smith Onandia Communications LLC., 161 Clubhouse Circle, Fairhope, AL, 36532. Phone (251) 510-2598. Publisher can not be held liable for non delivery due to circumstances beyond its control. No refunds. **SUBSCRIPTIONS & REPRINTS:** Annual rates for one subscription: U.S. \$55; Canada \$65; International \$95. Reprints are available on a custom basis. Contact Patricia Smith for multiple-subscription discounts, reprint quotations and customer service at (251) 510-2598 or email: patricia@airbestpractices.com. When available, extra copies of current issues are \$20. Standard postage 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, 161 Clubhouse Circle, Fairhope, AL 36532. Printed in U.S.A.

Wall Street Watch

The intent of this column, is to provide industry watchers with publicly-held information on NYSE-traded companies involved with the sub-industry of compressed air. It is not the intent of the column to provide any opinions or recommendations related to stock valuations. All information gathered, in this column, was as of market close January 5, 2007.

2006 Price Performance Winners

Gardner Denver (NYSE:GDI) and **SPX Corporation** (NYSE:SPW) completed 2006 with 12-month stock price increases of 47.3% and 31.8% respectively. Both companies cited strong organic sales growth, coupled with effective product rationalization and lean management strategies as key drivers. **Gardner Denver** also signaled that acquisitions contributed to the performance. This growth far out-paced the average growth in the industrials sector of 10.1% and of 9.5% in the industrial machinery sub-industry sector. **Gardner Denver** manufactures a full range of air compressors while **SPX** manufactures several compressed air treatment brands including **PPC Pneumatic Products** and **Hankison**.

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WALL STREET WATCH

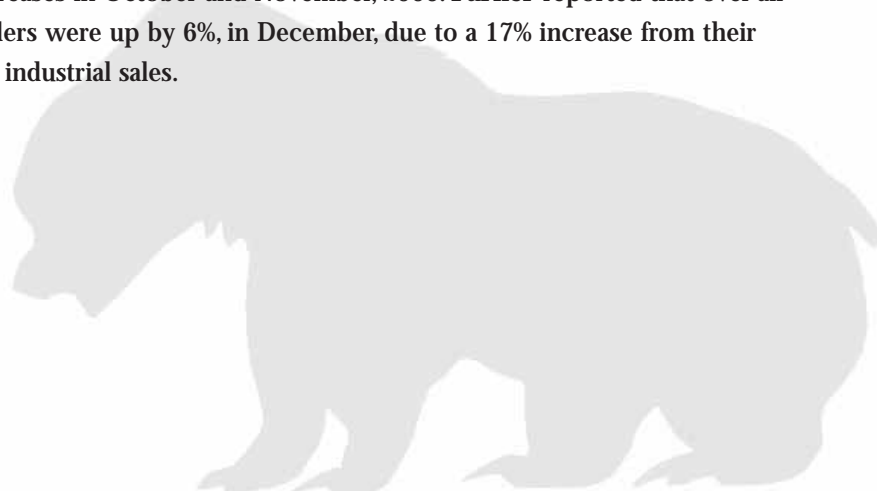
EnPro Industries (NYSE:NPO), the parent company of **Quincy Compressor**, posted a gain of 18.0%. **Parker-Hannifin** posted a gain of 12.4%. **Parker** manufactures a full range of pneumatic products and a full range of air treatment brands including **domnick hunter**, **Zander**, **Balston**, and **Finite**. **United Technologies** (NYSE:UTX) posted a gain of 12.0%. **United Technologies** manufactures the **Sullair** brand of air compressors.

JAN. 5, 2007 PRICE PERFORMANCE	SYMBOL	LAST PRICE	PRICE CHANGE YTD	1 MONTH	6 MONTHS	12 MONTHS	52-WEEK HIGH	52-WEEK LOW	BETA
Parker-Hannifin	PH	\$76.38	-0.7%	-8.7%	-0.1%	12.4%	\$88.00	\$67.46	1.16
Ingersoll Rand	IR	\$39.39	0.7%	1.3%	-6.9%	-4.0%	\$49.00	\$34.95	1.33
Gardner Denver	GDI	\$35.80	-4.1%	-4.9%	-3.3%	47.3%	\$40.73	\$24.29	0.96
United Technologies	UTX	\$62.68	0.3%	-3.2%	-1.8%	12.0%	\$67.47	\$54.20	0.66
Donaldson	DCI	\$34.26	-1.3%	-2.4%	3.2%	4.3%	\$38.97	\$30.16	0.93
Enpro Industries	NPO	\$31.99	-3.7%	-8.2%	-5.1%	18.0%	\$40.08	\$26.86	1.98
SPX Corp.	SPW	\$60.98	-0.3%	-1.7%	10.2%	31.8%	\$62.49	\$45.85	1.06
Industrials Sector				-0.6%	4.0%	10.1%			
Ind. Machinery Sub-Ind				-2.7%	0.7%	9.5%			

Market Slowdown in North America?

The stock market certainly thinks the market is slowing down. Six out of seven companies, on this chart, saw price performance decreases over the past six months. The only exception was **Donaldson** (NYSE:DCI), which was up 3.2%. **Donaldson** manufactures the **ultrafilter** brand of compressed air treatment products. **Donaldson** announced the opening of two plants in China, more than doubling its capacity there for making engines and industrial filters. The Company also announced the building of a new technical center for product design and development in China.

Parker Hannifin reported a 2% decrease in orders, in December versus the same time period a year ago, in their industrial division in North America. This is after 0% order increases in October and November, 2006. **Parker** reported that over-all company orders were up by 6%, in December, due to a 17% increase from their international industrial sales.



Or...a solid 2007?

United Technologies Corporation (NYSE: UTX), announced that revenues are expected to increase to \$51 billion in 2007 on mid single digit organic growth. Operating profit in all six UTC reporting segments should grow double digits and result in further operating margin expansion. Cash flow from operations less capital expenditures should again equal net income in 2007. The UTC Board of Directors, authorized a share repurchase program for up to 60 million shares worth approximately \$4 billion at current prices. The new authorization replaces the previous program, approved in March 2005, which was nearing completion. The company repurchased \$1.18 billion in shares during 2005 and expects 2006 repurchases to total \$2 billion. Chairman and CEO **George David**, in a December meeting with analysts, made the following observations.

“We expect solid performance again in 2007. Market conditions remain generally favorable worldwide, although the soft residential housing market in North America is a concern. Productivity improvements and restructuring savings, both UTC hallmarks, will also help drive profitability improvements. Commercial aerospace aftermarket volumes should continue growing, although at lower rates than in the last two years as the cycle matures. Commodity costs continue to be a headwind in 2007, but at a lesser rate than in 2006. The strength of the business portfolio combined with management depth and disciplines will continue to deliver strong results.”

The Board of Directors of **Ingersoll Rand** (NYSE:IR), whose stock price went down 4% in 2006, made a December announcement of the repurchase of up to \$2 billion of the company's Class A shares. “We believe that repurchasing our shares represents a good investment to enhance shareholder value,” said **Herbert L. Henkel**, Chairman, President and Chief Executive Officer. “The board's action reflects our company's solid fundamentals and sound balance sheet.”

JAN 5, 2007 COMPANY PERFORMANCE	SYMBOL	5-YR REVENUE GROWTH	1-YR EPS GROWTH	5-YR EPS GROWTH	RETURN ON EQUITY	1-YR PROFIT MARGIN
Parker-Hannifin	PH	9.4%	47.6%	12.3%	18.2%	8.3%
Ingersoll Rand	IR	4.6%	48.2%	18.1%	19.7%	9.2%
Gardner Denver	GDI	26.2%	30.9%	17.8%	16.9%	7.8%
United Technologies	UTX	10.0%	12.2%	11.9%	20.7%	8.8%
Donaldson	DCI	8.3%	13.8%	13.4%	25.1%	8.1%
Enpro Industries	NPO	5.1%	N/A	8.7%	5.9%	-1.9%
SPX Corp.	SPW	9.9%	N/A	N/A	5.4%	4.0%



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WALL STREET WATCH

Gardner Denver Optimism

The price performance leader in 2006, **Gardner Denver**, executed a two-for-one stock split (in the form of a stock dividend) that was completed on June 1, 2006. The Company issued statements reviewing the results of the third quarter in 2006 and providing an outlook into 2007. The Chairman, President and CEO of **Gardner Denver**, Ross Centani, offered the following comments,

"I am proud of the overall efforts of our employees in achieving another successful quarter. Our results reflect continued strength in our end market segments and my outlook remains positive. Although I expect our rate of growth to begin to slow in 2007, demand for compressor and vacuum products remains broad-based, both regionally and across product lines. In the third quarter, we began to see some increased demand for engineered products in North America. We believe we have gained share in compressor and vacuum product market segments, particularly in Europe and Asia where results continue to improve."

"I am also pleased with our operational improvements, including the inventory turnover improvements achieved this quarter as a result of previously completed lead-time reductions. In the third quarter, we continued to work with our suppliers to improve their performance and we completed the expansion of a manufacturing facility in China. The previously announced project to transfer production from Nuremberg, Germany to China and Brazil is expected to generate annualized savings in excess of \$3 million beginning in the second quarter of 2007."

"The rationalization of our European blower product lines and manufacturing facilities is well underway and the project remains on schedule and within budget. Through this project, we have merged the Rietschle and Wittig operations (located in Schopfheim, Germany) and are in the process of relocating the mobile blower product line from Wittig to a **Gardner Denver** facility in the U.K., where

other European mobile equipment is manufactured. In the fourth quarter of 2006, we expect to complete the rearrangement of the manufacturing facility in the U.K. and the installation of new machine tools required to increase output. As part of this project, we also plan to rationalize the **Elmo** and **Rietschle** side-channel blower product lines and centralize production of standard products. By the fourth quarter of 2007, when the integration project is scheduled for completion, common manufacturing processes will have been implemented to increase productivity and reduce lead-times and inventory. We also expect to reduce administrative and manufacturing overhead expenses. Once completed, this project is expected to reduce costs by approximately \$6.4 million annually and add manufacturing capacity."

"The Company expects orders for its compressor and vacuum products to remain strong through the remainder of 2006 and the rate of order growth for these products to begin to slow in 2007 from the current double-digit level. We anticipate revenue growth to continue in 2007 through a combination of the order growth and some reduction in backlog as operational improvements are achieved and integration projects are completed. During the third quarter of 2006, we experienced improved demand for engineered products in North America, primarily for geothermal applications and environmental projects. Lead-times associated with engineered products typically exceed those of more standard products, providing the Company more visibility into 2007 revenues. The economic environment in Europe and Asia also remains strong. We continue to experience good demand for our petroleum pumps and are currently taking orders for delivery of these products in the second half of 2007, also contributing to our visibility and favorable outlook. Further revenue increases for oil and natural gas-related products will depend upon our ability to identify additional outsourcing alternatives, implement incremental price increases and add machining capacity through selective capital investment."

JAN 5, 2007 VALUATION RATIOS	SYMBOL	PRICE/EARNINGS RATIO	PRICE/EARNINGS GROWTH RATIO	PRICE/BOOK RATIO	PRICE/SALES RATIO	DIVIDEND YIELD
Parker-Hannifin	PH	12.94	0.96	2.11	0.88	1.4%
Ingersoll Rand	IR	11.57	0.99	2.13	1.09	1.9%
Gardner Denver	GDI	15.87	0.95	2.36	1.13	N/A
United Technologies	UTX	17.66	1.41	3.32	1.29	1.7%
Donaldson	DCI	21.45	1.61	4.74	1.54	1.0%
Enpro Industries	NPO	21.74	1.47	1.17	0.74	N/A
SPX Corp.	SPW	24.76	1.57	1.82	0.83	1.6%

oil refinery rental air

BY COMPRESSED AIR BEST PRACTICES

Oil refineries are heavy users of compressed air. Fluctuating market conditions create surges in demand, for compressed air, in the refinery. Applications for compressed air include air-powered tools, catalyst regeneration, process heaters, steam-air decoking, sour-water oxidation, gasoline sweetening, and asphalt blowing. Instrument-air is provided for use in pneumatic instruments and controls, air motors, and purge connections. Rental air compressors and dryers provide an effective solution for handling surges in compressed air demand.

Rental Oil-Free Air Compressors, Photo courtesy of Aggreko LLC.



OIL REFINERY RENTAL AIR

Catalyst Regeneration and Purging “Cat Crackers”

Oil refineries often face the need for temporary increases in capacity. The most common demand driver is for gasoline, during the summer months. The increased throughput will cause an earlier fatigue of catalyst. The catalyst regeneration process, in an oil refinery, uses compressed air to purge vessels and to regenerate the catalyst. Scheduled and emergency outages, at the refinery, result in temporary demand for “Oil-Free” compressed air in the catalyst regeneration process.

The large, upright vessels, such as distillation columns and vacuum flashers, also require periodic maintenance. These vessels have many trays where moisture will accumulate when opened to atmosphere. The moisture must be removed from the steel towers prior to being put back into service.

Hot nitrogen, sometimes produced on-site but more often supplied by trucked-in pumper units, is used to purge the vessels of moisture. Compressed air is a more cost-effective method of purging the vessels of moisture in any process where the introduction of oxygen does not create a safety hazard. Often, oil-free compressed air can be introduced while workers are present to maintain a positive pressure and minimize the entry of moisture in the repair and inspection phase. This can not be accomplished with nitrogen as it will create a nitrogen rich environment that is unsafe to workers. Mark Shedd, the Business Development Manager for Oil-Free Air at Aggreko LLC, informs, “Oil-free compressed air is more cost-effective, than hot nitrogen, for vessel purging of moisture in the refinery”.

*Refinery in Germany with Oil-Free Air Compressors,
Photo courtesy of Aggreko LLC.*



De-coking the Catalyst and the Main Air Blowers

In order to regenerate the catalyst in a “cat cracker” vessel, the catalyst must be “de-coked”. “De-coking” is the process where catalyst residue is burned. This can only occur when oxygen is introduced, to increase the temperature of the burn, which then permits the burning of catalyst residue. Compressed air is used to introduce the required levels of oxygen.

Refineries have main air blowers supplying air to the entire facility. Rental oil-free air is often used to supplement the volume of air required, or to ensure redundancy for the refinery. When ambient temperatures go up and oxygen content goes down, compressed air is fed into the intake of the main air blower. This is a more cost-effective supplementation method, to maintain oxygen levels, than using liquid oxygen.

Refineries have 100% redundancy requirements for their main air blower systems. A refinery can not produce without the main air blower system so it is therefore a critical application. A shutdown, of course, will cost the refinery millions of dollars per minute. If repairs are needed on the air blower, rental oil-free compressed air will be brought in to replace it during repair. The back-up blowers are thereby maintained in reserve to ensure redundancy.

“Oil-free compressed air is more cost-effective, than hot nitrogen, for vessel purging of moisture in the refinery.”

MARK SHEDD, AGGREKO LLC

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Rental Desiccant Air Dryer, Photo courtesy of SPX Dehydration & Process Filtration

Oil-Free Rental Air Compressors

The specification for compressed air at refineries has long called out for oil-free air. The tolerances of pneumatic actuators and other delicate pneumatic devices can be thrown out of line by the presence of any moisture or oil in the compressed air system. Refineries, therefore, have specifications calling for oil-free air compressors followed by air dryers.

To take care of temporary peaks in demand, the rental compressors that most refineries use are electric-driven, oil-free, rotary screw air compressors. Electric-driven is chosen over diesel simply due to the availability of electric power. The majority, operate at outlet air pressures below 150 psig. The air compressors will require 480V, three-phase, 60-Hz power. Most air compressors feature integral inter and after-cooling which keeps outlet air temperatures to 25 °F above ambient temperatures. Some offer optional packages which can keep this approach temperature to 20 °F. Most rental compressors will also offer optional heating circuits for low ambient conditions.

Rental Compressed Air Dryers

The compressed air, coming from the oil-free air compressors, must be completely dry. Oil refineries typically specify a -40 °F pressure dew point, although some will specify a -100 °F pressure dew point. Rental desiccant dryers can be field-adjusted to deliver either dew point requirement. Refineries personnel, however, must understand that a specific air dryer will consume a greater percentage of the air to deliver a -100 °F pressure dew point than to deliver a -40 °F pressure dew point. While sizes will range from 115 to 5400 scfm, a popular model is the 1550 scfm desiccant air dryer. The inlet rating of 1550 scfm matches up well with the most commonly-rented air compressor sizes. The air delivered at the outlet of the 1550 scfm model will be 1327 scfm (for a -40 °F dew point) and 1309 scfm (for a -100 °F dew point).

“Most vessel and pipeline-drying applications specify a -40 °F or better dew point.”

DAN PURVIS, SPX DEHYDRATION
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Air quality is further ensured by skid-mounted particulate and oil-removal prefilters and particulate after-filters — all equipped with automatic condensate drains. Oil-removal prefilters are required to prevent contamination of the desiccant bed in the dryer. Particulate after-filters ensure that no desiccant dust is swept downstream of the dryer. A major supplier of rental air dryers is SPX Dehydration & Process Filtration. The Rental Division Manager, Dan Purvis, says “most vessel or pipeline-drying applications specify a -40 °F or better dew point. We have had some large-diameter, long-distance, pipeline-drying applications which targeted a -80 °F dew point”.



Rental Refrigerated Air Dryer, Photo courtesy of SPX Dehydration & Process Filtration

Rental desiccant dryers are designed for outdoor installations. They are installed on heavy-duty frames with lifting lugs and forklift channels for easy handling. The electricians are suitable for outdoor operation and are normally NEMA 4, 115/1/60. They can also be made “all-pneumatic” if electric power is not available. Full instrumentation packages will advise of any system malfunctions. Systems are normally designed for ambient temperatures between 35 °F and 120 °F. Low ambient packages are available which ensure system operation at ambient temperatures of -10 °F.

Fluctuating market conditions create surges in demand at oil refineries. Rental oil-free air compressors and dryers provide an effective solution for handling the compressed air requirements in these situations.

MAJOR REFINERY PRODUCTS*

- 1 Gasoline.** The most important refinery product is motor gasoline, a blend of hydrocarbons with boiling ranges from ambient temperatures to about 400 °F. The important qualities for gasoline are octane number (antiknock), volatility (starting and vapor lock), and vapor pressure (environmental control). Additives are often used to enhance performance and provide protection against oxidation and rust formation.
- 2 Kerosene.** Kerosene is a refined middle-distillate petroleum product that finds considerable use as a jet fuel and around the world in cooking and space heating. When used as a jet fuel, some of the critical qualities are freeze point, flash point, and smoke point. Commercial jet fuel has a boiling range of about 375–525 °F, and military jet fuel 130–550 °F. Kerosene, with less-critical specifications, is used for lighting, heating, solvents, and blending into diesel fuel.
- 3 Liquefied Petroleum Gas (LPG).** LPG, which consists principally of propane and butane, is produced for use as fuel and is an intermediate material in the manufacture of petrochemicals. The important specifications for proper performance include vapor pressure and control of contaminants.

- 4 **Distillate Fuels.** Diesel fuels and domestic heating oils have boiling ranges of about 400°–700 °F. The desirable qualities required for distillate fuels include controlled flash and pour points, clean burning, no deposit formation in storage tanks, and a proper diesel fuel cetane rating for good starting and combustion.
- 5 **Residual Fuels.** Many marine vessels, power plants, commercial buildings and industrial facilities use residual fuels or combinations of residual and distillate fuels for heating and processing. The two most critical specifications of residual fuels are viscosity and low sulfur content for environmental control.
- 6 **Coke and Asphalt.** Coke is almost pure carbon with a variety of uses from electrodes to charcoal briquets. Asphalt, used for roads and roofing materials, must be inert to most chemicals and weather conditions.
- 7 **Solvents.** A variety of products, whose boiling points and hydrocarbon composition are closely controlled, are produced for use as solvents. These include benzene, toluene, and xylene.
- 8 **Petrochemicals.** Many products derived from crude oil refining, such as ethylene, propylene, butylene, and isobutylene, are primarily intended for use as petrochemical feedstock in the production of plastics, synthetic fibers, synthetic rubbers, and other products.
- 9 **Lubricants.** Special refining processes produce lubricating oil base stocks. Additives such as demulsifiers, antioxidants, and viscosity improvers are blended into the base stocks to provide the characteristics required for motor oils, industrial greases, lubricants, and cutting oils. The most critical quality for lubricating-oil base stock is a high viscosity index, which provides for greater consistency under varying temperatures.

*Source: U.S. Department of Labor, Occupational Safety & Health Administration, Technical Manual, Section IV, Chapter 2, Petroleum Refining Processes, www.osha.gov

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COMPRESSED AIR AS A HOLE-CLEANING FLUID

BY HANK VAN ORMER

Compressed air has been used for years in the rotary drilling industry as a hole-cleaning fluid. The cuttings are moved away from the borehole by the circulation of air under pressure. Normally compressed air is circulated while drilling in a dry formation. In formations where water is present, compressed air is mixed with foam and/or mud for better results.



Mobil drill rig with two Ingersoll Rand 750 cfm @ 350 psi air compressors

Operating Principles of Rotary Air Drilling

Air rotary drilling was first developed for use in drilling water wells. Roller-type rock bits are used to do the drilling. They consist of roller cones with teeth mounted on a bit body. The bit is then rotated with down pressure. Down pressure is created by the drill rods being rotated. As the bit turns, the cone rotates under the bit. The teeth on the bit strike the formation causing rock breakage and chips. The continuous air blast tends to help “break” the rock chip loose.

Air is directed into the drill pipe and kelly, through the bit as it rotates. The air comes out at the bottom of the bit, strikes the chips being cut loose, and blows them away from the bottom of the bit. This exposes new rock surface for the bit to drill. The velocity of the air, coming out of the bit, carries these cuttings away from the bottom of the bit and returns them to the surface. These cuttings are blown to the surface between the hole that has been drilled and the drill pipe.

COMPRESSED AIR AS A HOLE-CLEANING FLUID

ADVANTAGES

1. Lower cost hole cleaning that is always available. In mobile rigs particularly, often the main drilling power is an air-powered, down-hole tool. This means air will also be available to clear the cuttings.
2. The extreme pressure differential, between the bit face pressure and borehole pressure, makes air more effective clearing the bit face than liquid. This increases the penetration rate and decreases bit wear.
3. Immediate and continuous detection of minerals, hydrocarbons, and other significant cuttings.
4. Minimum damage to liquid sensitive pay zones.
5. Better control of lost circulation and the ability to recover cleaner cores.

DISADVANTAGES

1. Pressure and volume limitations (available horsepower), particularly on single mobile drilling rigs, limits both the hole sizes and depths available for practical air drilling. It has become common and practical to use auxiliary air packages for larger jobs.
2. For maximum versatility, on a stationary or mobile rig drilling in a variety of conditions, a mud system may be required anyway along with the air system.
3. Sensitive to incoming water produced in the formation.
4. Doesn't perform well, or at all, in soft or unconsolidated formations.
5. Higher risk of down-hole fires and explosions.
6. Increased potential of sloughing of formation (dry or wet).

IN ROTARY AIR DRILLING



Rotary drill rig mounted on a truck

Factors to Consider

There are several factors to keep in mind when considering the use of compressed air as the hole cleaning media. The first is the fact that hard formations, which are dry or which produce relatively low formation of liquids, are the best areas to achieve optimum results when air drilling. The cleaner bit face (due to pressure differential) and the more effective rock breakage at the hole face, combine to provide optimal air drilling performance.

Well or gas-control, when air drilling, is safer and easier than with mud. In mud drilling, gas can enter the well bore on trip and remain undetected — due to the reduced hydrostatic pressure. This can create well control problems.

The final factor to consider is that the ability to air drill is dependent upon the amount of incoming water in the formation. A small amount of water can often be absorbed into the cleaning air stream and still result in effective “dust drilling”. Large water-producing formations are the biggest enemy of air drilling. The exact rate of incoming water that can be handled is dependent upon many many factors including; hole size, pipe size, and available air pressure. When large water-producing formations are encountered, mist (or foam) drilling and/or aerated (“slug”) drilling can be done. As a rule of thumb, “foam drilling” can handle up to 200 barrels per hour of incoming water while aerated drilling can handle larger amounts (depending upon the available air pressure and volume).

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COMPRESSED AIR AS A HOLE-CLEANING FLUID IN ROTARY AIR DRILLING

Air Mist (Foam) Drilling

When air drilling, one of the first indications that a water-producing formation has been encountered is a reduction in or a complete stoppage of “dusting” at the blow line. Circulation pressures will fluctuate and then increase substantially. When water-producing formations are encountered, the cuttings “ball” in the hole and “bridge”. The compressed air above is not able to clear the hole.

Air mist drilling consists of injecting a foaming agent (or a mixture of a foaming agent with water) into the compressed air stream. Generally, the foaming agent is continuously injected with only enough water to carry foam to the bit. If there is insufficient formation water to disperse the cuttings, more water is added at the surface with the foaming agent.

1. Although the pressure differential is less than air drilling, it is significantly more than mud. The bit-face, therefore, clears less effectively than with air but much better than with mud. This means that when compared to straight mud drilling, faster penetration and better bit-life is achieved.
2. Because the foam is denser than air, it lifts cuttings at much lower velocities.
3. Foam tends to keep the cuttings separated and prevents them from “balling” up and becoming consolidated which leads to “bridging”.
4. Foam lightens the weight of the water column significantly, which lowers the maximum pressure required for effective circulation. Lower pressure requirements mean lower associated energy costs to produce air pressure.
5. Foam drilling does require a higher air pressure than does air drilling. Foam does, however, require significantly lower volumes of air to effectively clean the hole.
6. The “stiffness” of the foam can be altered to fit conditions and to handle bigger and heavier cuttings than straight compressed air — yet requires fewer additives than straight mud.
7. Foam, combined with other additives (soap, shale stabilizers, corrosion inhibitors, . . . etc.), can be of significant help in many areas of drilling. Foam, correctly mixed, can tend to stabilize unconsolidated formations.
8. Foam tends to ease and make safer the entry into gas zones as it cools, kills sparks, and holds stable pressures.

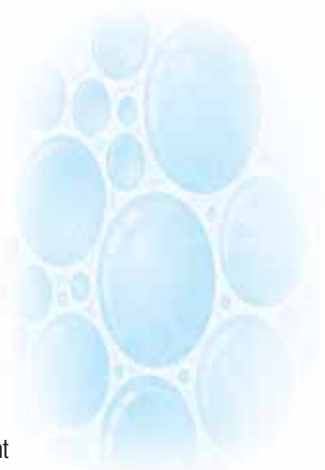
Aerated Mud Drilling

When drilling conditions (normally the volume of water intrusion increases) change to the point that proper hole cleaning cannot occur with foam or air mist drilling, beneficial results can be obtained by switching to aerated mud drilling. This is done by adding foamer either directly into the main mud slush pump suction — or into the air injection line. Aerated mud often allows for increased pressure differential for better chip cleaning and higher flow of cleaning fluids — with less pressure than a conventional mud system. Good aerated mud drilling combines air and fluid into a stable mass that does not break down or separate until it reaches the surface pits. The air must then separate in the pits before going back to the mud.

Compressed air provides drilling rigs with flexibility as a hole-cleaning fluid. Depending upon the formations encountered, compressed air can work alone or be combined with foam or mud to get the job done.

The foam column is maintained so that continuous returns are obtained at minimum air pressure. The air pressure is a function of the density of weight of the foam and the height of the column.

Most foamers are a liquid concentrated anionic surface active agent especially formulated to mix with the water available. It is important to select a foamer that is compatible with the water to be encountered (such as clean water or high-chloride brine). The foamer reacts with the water and increases the surface tension, allowing the formation of air bubbles (or foam) as it mixes with the compressed air. The foam itself now becomes a moving column of hole cleaning medium somewhere between air and water. Foam drilling offers many benefits to the drill performance;



Mr. Hank Van Ormer is a leading compressed air systems consultant who has implemented over 1200 air improvement projects. He can be contacted at (740) 862-4112, email: hankvanormer@aol.com, and www.airpowerusainc.com

ROTARY AIR DRILLING — SIZING THE COMPRESSED AIR SUPPLY

BY HANK VAN ORMER

For either rotary air drilling or down-hole hammer drilling, there are two main criteria to be considered when selecting an air compressor for the job; air pressure and air volume. In order to determine air pressure and air volume, the challenges facing the rig must be examined. Borehole characteristics, water columns, and air delivery systems are the most important. This article is written to help rotary air drillers ensure that the correct compressed air volume and pressure can be delivered to the bottom of the borehole.



ROTARY AIR DRILLING — SIZING THE COMPRESSED AIR SUPPLY

Air Pressure (PSIG)

The primary function of air pressure is to overcome borehole pressure (water head, foam head,...etc.) and to assure the optimum performance of the down-hole tool. In the case of a water head, maximum pressure is required to begin circulation from the bottom of the hole. Once circulation has begun, pressure requirements drop off.

It is very hard to accurately predict the static head of pressure in a borehole, caused by a column of fluid. Since this is directly proportional to the density of the fluid, a 1000 ft column of salt water, will create a higher bottom-hole hydrostatic pressure (PSI) than pure water. Pure water will conversely create a higher static head pressure than a foam column. In any event, this bottom-hole hydrostatic pressure must be overcome in order to effectively blow the hole.

A relatively accurate “rule of thumb”, that can be used, is to establish a multiplier which times the height of the fluid column, will approximate the bottom-hole hydrostatic pressure. Following are some helpful multipliers:

FLUID COLUMN	MULTIPLIER
Pure Water	.45
Salt Water	.50
10 lb. Mud	.52
15 lb. Mud	.78
20 lb. Mud	1.2

Example: Take the multiplier x the column height (ft.) = bottom-hole hydrostatic pressure. A 1150 foot bore hole with a 1350 foot column of pure water will have a bottom-hole hydrostatic pressure of: 1350 ft. x .45 = 607 PSIG.

The example above means that in order to blow this column of water from the bottom, the compressed air system, on the job, must be capable of delivering over 607 PSI to the bottom of the hole! Foam can be added to decrease the density of the water column and thus lower the hydrostatic borehole pressure.

Portable Two-Stage Air Compressor



Air Volume (CFM)

The main function of air in rotary air drilling is to cool and clean the drill bit, as well as carry the drill cuttings from a borehole. It is important that the hole bottom and drill bit be kept clean and cool for optimum life and penetration. Once these cuttings have been cleared from the face of the bit, they must be carried up and out of the borehole.

To do this cooling and cleaning, air volume (CFM) is the primary consideration. For any size cuttings, there is a critical minimum velocity which will cause the rock fragments to accelerate enough to overcome gravity and friction to rise up the borehole. This velocity is a function of air volume (CFM) and annular area (difference between drill pipe OD and borehole diameter).

At a given borehole diameter, the air velocity will be too weak to clear the face and lift the cuttings out of the borehole — this is the critical minimum velocity. Under normal conditions, this critical minimum velocity will be about 3000 FPM (feet per minute). There is also a maximum bailing velocity, above which the bit and drill pipe will be damaged from the “sandblast effect”. Under average drilling conditions, a bailing velocity of over 7000 FPM should be avoided. The amount of effective bailing velocity is directly effected by four conditions that must always be considered:

1. **The size and weight of the chips:** the larger and heavier the chips are, that clear the bit face and flow up the annular area (between the pipe wall and hole wall), determines whether a high velocity or a lower velocity up-hole flow is required. The heavier the cutting or chip, the more flow is required.

2. **Changes in annular area:** changes in borehole diameter or drill pipe, increase (or decrease) the annular area that the cleaning air must flow through — this change is followed by an immediate change in velocity. For example: a 4½" OD pipe with a 8¾" hole with 2000 cfm = 6400 FPM bailing velocity. A borehole change to 9¾" gives a bailing velocity of 5500 FPM. This sudden change of bailing or cleaning velocity, will often cause the heavier cuttings to fall out. Care must be taken to avoid this (keep bailing velocities high enough) or correct the condition (more air to clean, foam injection, ...etc.) as this can and will lead to "bridging" with eventual loss of circulation.
3. **The influx of formation water:** this can cause the smaller chips and dust to "ball" thus increasing their size and weight and finally making them too heavy to clear the hole — which also can lead to "bridging".
4. **Formation conditions:** formations such as faults and caverns can also dramatically alter the bailing velocity by either "stealing" the air or changing the borehole diameter and subsequently the annular area.

Bailing Velocity

Thus an air compressor should be selected for a drilling rig that will provide enough air volume (CFM) to maintain a bailing velocity of 3000 to 7000 FPM for effective air drilling (many drillers feel 5000 FPM is the optimum velocity). There is a very handy formula used to compute the bailing velocity. This formula deals with what is called the Annular Area (the area between the OD of the drill pipe and the diameter of the borehole).

Bailing Velocity = CFM x 144 / Annular Area
 Annular Area = (Area of hole) – (Area of pipe)

Area of a Circle = πr^2

Example: a 8" borehole and a 4½" pipe with 725 cfm, will have what bailing velocity

Answer: $725 \times 144 / (3.14 \times 42) - (3.14 \times 2.252)$

Bailing Velocity = 3039 FPM



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ROTARY AIR DRILLING — SIZING THE COMPRESSED AIR SUPPLY

Air Hammer Drilling-Principles of Operation

Air hammer drilling uses the same drill rods, from the machine, down into the hole to attach to the top of the hammer. The drill rods are rotated by the rotary head, or rotary table, and thus rotate the air hammer. Drilling is accomplished by the piston in the hammer hitting directly on the bit itself, which then chips the rock face. The rotation keeps the hole round and allows the use of a bit that does not completely fill up the hole. This is similar to putting the bit on the rock, and with a sledge hammer, hitting the top of the bit to give the hammer action. Even though the design of hammers may vary, they all basically work on the same principle.

The compressed air that has driven the piston down on the hammer blow, then continues on through the bit to clean the hole. Most down-hole hammers also have adjustable bypass plugs that can be used to increase available hole cleaning air than the hammer action can normally allow to pass. This is most important to consider when calculating the necessary air required to clean the hole properly.

The chips are knocked out of the formation by the bit striking them. The air, coming out of the bottom of the bit, lifts these chips and carries them back to the surface, on the outside of the hammer and drill pipe.

In harder, or more dense rock formations, higher air pressure is often required to increase the energy of the blow, to effectively chip the rock. Over the last decade, a great deal of development has occurred in the design of down-hole hammers capable of delivering this increased energy on a continuing basis. Today, there are effective hammers operating at pressures up to 350 psig. It is important to note that as the operating pressures are increased, the ability of the tool to pass significantly more cleaning air increases — this can be very important when planning the next drilling job.



Drill Bit Used in Air Drilling

In larger boreholes, or other conditions causing loss of bailing velocity below the critical minimum velocity, a more viscous or denser cleaning medium is required to lift the drill cutting. A more viscous medium, such as foaming agent mixed with air, will hold the cuttings in suspension and carry them from the borehole. Various amounts of water mist and foam can be injected into the air stream. Generally, the thicker the foam mixture circulated with the air, the lower the bailing velocity required to clean the borehole (as low as 200 FPM has been successful). When thick foam is used, high bailing velocities should be avoided, as they can “blow-out” the foam column. Bailing velocities should be maintained at a level where a smooth, continuous flow of foam is coming from the borehole. Sometimes the addition of standard “mud additives” into the foam, will help in unstable or unconsolidated ground conditions. This can avoid, or delay, needing to switch to a full mud system — with its associated lower penetration rates and lower bit life.

Table: Proper Matching of Hole Size with Rod Size

ROD SIZE	HOLE SIZE	AIR VOLUME (CFM)	VELOCITY (FPM)
4½"	9½"	1700	4314
4½"	17"	1700	1160
4½"	22"	1700	673
4½"	9½"	1150	2918
4½"	9½"	2300	5836
4½"	17"	2300	1569
4½"	22"	2300	951
3½"	9½"	1150	2618
3½"	9½"	1317	3000
3½"	17"	4530	3000
3½"	22"	7720	3000

Controlling Pressure Loss

In determining the air volume (CFM) and pressure (PSIG) needed to successfully air drill a given borehole, consideration must also be given to assuring the rig and pipe string can deliver the volume and pressure to the bottom of the borehole, without unacceptable pressure losses. This pressure drop is easy to understand since air is a fluid that reacts just like a garden hose with water. The longer the garden hose, the less pressure at the end. The same is true with air. The pressure loss is caused by the friction of the air mass flowing on the inside walls of the pipe or hose. The larger the pipe, the more air it will carry in the center, not causing friction loss on the inside walls.

The pressure drop (or loss) is the function of the volume (quantity of air flow), the initial air pressure, the size of the pipe (or hose), the type of pipe (or hose), the length of the pipe, and the number of valves, couplings, and bends in the system. The following selection of representative drill pipe sizes and CFM values, clearly show the importance of pressure loss when running a 2000 ft. or a 7000 ft. string. Remember these values are only the losses in the drill stem itself and additional consideration must be given to:

1. Rig losses due to orifices, couplings, joints, king swivels
2. Is the drill pipe external or internal-flush at the joint
3. Assume the DHD or roller bit will be matched to effectively pass the required volume

DRILL PIPE SIZE	INITIAL PRESSURE (PSIG)	CFM	PRESSURE LOSS (PSIG) W/2000 FT. STRING	PRESSURE LOSS (PSIG) W/7000 FT. STRING
3/4"OD 2 1/2"ID	125	1500	100	350
3/4"OD 2 1/2"ID	125	1700	300	1050
4/4"OD 3 1/2"ID	125	1500	20	70
4/4"OD 3 1/2"ID	125	1700	30	105
3/4"OD 2 1/2"ID	250	1500	32	112
3/4"OD 2 1/2"ID	250	1700	54	189
4/4"OD 3 1/2"ID	250	1500	6	21
4/4"OD 3 1/2"ID	250	1700	11	38

NOTE: The significant difference in pressure loss with 250 psig in lieu of 125 psig initial pressure

In summary, matching the compressed air supply to the drilling conditions, requires some simple steps. Determine the borehole characteristics and subsequently the annular area to be cleaned. Check this against the required air volume to properly clear the cuttings. If the volume on the rig is adequate, or with auxiliary air is adequate, check the anticipated maximum water column height to predict maximum pressure required. If the pressure on the rig is adequate, or with auxiliary compressors or boosters can be made adequate, check the air delivery system (rig, pipe,...etc.) to be sure the correct volume and pressure can be delivered to the bottom of the borehole.

Mr. Hank Van Ormer is a leading compressed air systems consultant who has implemented over 1200 air improvement projects. He can be contacted at (740) 862-4112, email: hankvanormer@aol.com, and www.airpowerusainc.com

“It is very hard to accurately predict the static head of pressure in a borehole, caused by a column of fluid.”


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McKenzie Equipment Company

Compressed Air Best Practices interviewed Mary Ann Goode
(CEO & President) of McKenzie Equipment Company



McKenzie Equipment Management in Houston;
Mike Valore, Mary Ann Goode, Delvin Haas
(from left to right)

Good morning! How's the oil patch doing?

Well, business at McKenzie Equipment Co. is great right now. The drilling contractors in Houston are extremely busy building and refurbishing rigs, for both land and offshore, and the uses for compressors on those rigs are numerous and varied. And of course, other businesses which provide upstream or downstream products and services, whether it is manufacturing drill pipe or drilling tools, or refining and transporting product, are also in need of compressed air and are keeping us busy.

This isn't McKenzie's first positive oil-drilling cycle is it?

No, as a matter of fact, since 1960 when McKenzie was founded, we've lived through a number of "booms" and the consequent "busts"! And, though there have been significant changes in the oil and gas business with the acquisitions and "rollups" over these last 46 years, today McKenzie still does business with many of the same customers who bought Quincy compressors from my grandfather and father.

The "booms" and "busts" are precisely the reason that McKenzie has developed a strong presence in the Houston industrial and medical markets and expanded into other major geographical regions in Texas where oil and gas is not as dominant. We need diversity to protect against the volatility of the oil and gas market and to minimize the effect a downturn can have on our business.





Re-building a high-pressure LeRoi compressor

What distinguishes McKenzie Equipment?

As specialists of compressed air, McKenzie provides a breadth and depth of products and services with which few companies can compete. We have years of knowledge and experience, whether it is service technicians or sales engineers. We also have the capability in technology and size to do business with very large organizations.

Most importantly, McKenzie stands for excellence in customer service. Our people understand that even minor breakdowns in an air system can be devastating to the entire operation of a rig or other business. McKenzie's service team responds quickly and aggressively to help our customers minimize downtime and maximize their production capabilities on a 24/7 basis. Whether it's a small part, an air end failure, a rental on Christmas Eve, an explosion-proof custom built air package, or an equipment problem offshore, McKenzie Equipment can and will do it quickly.

“Offshore and land rigs typically have several compressors.”

MCKENZIE EQUIPMENT COMPANY



Mary Ann Goode and Raymond Roberts inspect a Quincy QR-25 Reciprocating Air Compressor

“Standardization
helps rig
builders reduce
inventory
requirements”

What kinds of applications does McKenzie see for compressed air in the drilling industry?

Offshore and land rigs typically have several compressors. In addition to the cold start packages used to start diesel engines on rigs, other compressors are used to supply air to pneumatically-operated equipment like hoists, clutches, air-operated tools, and pneumatic controls. Low pressure high volume air is used to move drilling fluids to storage tanks before it is sent down the well. Diesel driven compressors are used as well in flare boom applications.

How have you developed your business with your oil industry customers?

McKenzie has played a major role in helping a number of large rig builders standardize their rig fleets on our particular compressed air products. McKenzie employees, like our Sales Manager, Mike Valore, regularly attend rig planning meetings and have served on product standardization committees. With standardization and on-line visibility of inventory, 50 operating rigs can share inventory, reduce over-all inventory requirements, as well as improve delivery efficiency. Standardization also provides a level of familiarity with the equipment to the rig hands tasked with maintenance and repair. This familiarity is critical in remote locations and particularly offshore.

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U.S.	\$55.00	\$50.00	\$45.00	\$40.00
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International	\$95.00	\$90.00	\$85.00	\$80.00

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- 2.) Email us at patricia@airbestpractices.com and mail your check.
- 3.) Mail your information and check to:
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161 Clubhouse Circle
Fairhope, AL 36532

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McKenzie Explosion-Proof Air Compressor

One of the many examples of the benefits of standardization is the application of a Quincy QR 25 reciprocating compressor which is now used on a cold start package that starts diesel engines on rigs. McKenzie has earned a sterling reputation as one of the early pioneers in 1960 of customized compressed air equipment and services critical to the drilling industry.

Another thing McKenzie has done is to partner with customers and streamline communications through on-line business processes. Whether it is entering invoices online, providing online parts catalogs or other needed documentation, collecting payments, or giving them a "live" person to talk to, we make it easy for customers to do business with McKenzie. We do it their way.

MCKENZIE EQUIPMENT COMPANY



Diesel-Driven Air Compressors for Flare Boom Applications

What about the future?

The last couple of years are certainly unprecedented in terms of the volume that we've seen as a result of the oil and gas industry. As long as the worldwide demand for oil and gas stays strong, we expect to continue this level of activity into 2007 and beyond. But because of McKenzie's strength in the industrial and medical markets, we will stay strong and continue to grow, regardless of whether it's "boom" or "bust" times in the oil patch.

Mary Ann talked about McKenzie's capabilities to fabricate explosion-proof packages. Mike (Sales Manager-Mike Valore), please tell us more about those packages.

Explosion-proof packages are one of McKenzie's specialties. This capability requires expertise that most compressor distributors and manufacturers do not have. We supply explosion-proof Rig-Air and Bulk-Air air compressors. These compressors are installed in hazardous areas and must meet Class 1, Group D, Division 1 requirements. Often we will retrofit an air compressor's control system, panel, solenoid valves, motors and differential pressure switches to make it explosion-proof.



McKenzie Diesel-Driven Cold-Start and Black-Start Air Compressors



Inspecting Quincy OSI Rotary Screw Compressors and Air Treatment Skid Before Shipment

How about cold-start and/or black-start packages?

McKenzie has many years of experience building tank-mounted, diesel-driven, cold-start and black-start packages. They are used to fill storage tanks that supply air to start the large engine/generator packages on drilling rigs when power is not available. These packages have also been used for starting air for large generators and general air for site work.

Tell us more about Flare Boom applications.

Sure. Some rigs use large diesel-driven air compressors for flare boom applications to safely burn any oil or gas that flows up the well bore to the rig while a well is being drilled or tested. We provide compressors that are outfitted with required safety features such as spark-arresting mufflers, galva-neal and powder coating for corrosion protection, and air intake shut-off valves with emergency pull-handles.

What challenges face the drilling industry with their air systems?

Our customers tell us that their biggest challenge is finding personnel who can fix and repair the equipment they use on their rigs. The McKenzie team is proud to assist its customers with full service-shop capabilities and also by providing very durable air compressor designs like Quincy Compressors. For this reason, McKenzie sells Quincy low-pressure (QSLP Series), higher-pressure (QSI Series) rotary screw, and the legendary Quincy QR-25 reciprocating compressor line.

Thank you McKenzie Equipment for your insights.

*For more information, please contact Mary Ann Goode, McKenzie Equipment:
Tel: 800-764-9793, email: Info@mckenzieequipment.com*

ATLAS COPCO & TIDE AIR, COMPETENCE

Compressed Air Best Practices interviewed Paul Hense (President), Dave Prator (VP Region South) and Jim Lekberg (VP of Finance), of Atlas Copco Compressors LLC.

Good afternoon! How are things at Atlas Copco USA?

Hello. Growth for Atlas Copco has been tremendous, in the USA, over the past five years. We have grown both organically and through acquisitions, like Tide Air in Houston. Our organic growth has come from all three of our divisions: portable air, industrial air, and oil-free air. The acquisitions have been primarily of compressor sales and service companies, located in geographies where we knew significant growth would occur under Atlas Copco ownership. When we purchase these companies, we have the ability to invest in larger sales and service efforts, which result in larger market shares for the Company and better service for our customers. At Atlas Copco, we have doubled the number of sales people and tripled the number of service people during this period.

Please describe the Tide Air acquisition.

Tide Air has become what we call a “Competency Center” for the oil and gas industry, for Atlas Copco in the Americas. Tide Air has served the oil and gas industry successfully, for over thirty years, using Atlas Copco compressors in their packages. By acquiring Tide Air in September of 2006, we were able to reinforce their ability to make custom packages for the all the segments of the oil and gas industry served out of our U.S. and Canadian subsidiaries. A core value, at Atlas Copco, is customer interaction. The oil and gas industry has a unique set of needs. Acquiring Tide Air has given Atlas Copco a direct line of communication to this segment of customers.



Paul Hense, President, Atlas Copco USA



Custom skid package of two 100 horsepower air compressors, a refrigerated dryer, and a receiver tank. Installed at a petrochemical facility along the Houston ship channel.

Atlas Copco

CLOSE TO THE CUSTOMER

Does Atlas Copco/Tide Air supply packages globally?

The oil and gas industry is a global business. Offshore rigs can be located anywhere in the world. Every energy company has unique material and process specifications for their rig air. Rig air specifications will cover many areas including electrical, air treatment, explosion-proof, and water-cooling specifications. The Tide Air/Atlas Copco Competence Center is able to design packages which adhere to ASME, ANSI, AISC, AWC, NEMA, OSHA, API, NEC, IEC, IP, BS, API...to name a few specifications! We receive weekly visits from customers' inspectors and know how to efficiently work with them. Being located in Houston, where the certification agencies are, is also efficient for both parties.

What kind of water-cooling specifications do you see for compressors?

Some offshore rigs in Africa and South America use salt-water for cooling. The salt-water is then pumped through the compressor coolers to cool the oil and the compressed air. We utilize special copper-nickel coolers, which hold up under salt water.

Work-boats, which supply and service offshore rigs, have different specifications. Work-boats carry drilling mud, for example, out to the rigs. Compressed air moves the slurry, from the tanks on the boat, onto the rig. Many of these air compressors, installed on the work-boats, use fresh water which is circulated in the boat. The compressor coolers, therefore, are standard water-cooled coolers.



Offshore rig package of two 200 horsepower air compressors and an internally heated desiccant air dryer. Built with explosion-proof panels, offshore paint, and all seal-welded construction. Installed on an offshore rig, west of India.

ATLAS COPCO & TIDE AIR, COMPETENCE CLOSE TO THE CUSTOMER

How about un-manned production platforms?

There are many un-manned oil production platforms operating in areas with extreme temperature variations. Once the well is complete production platforms are constructed. Most of these production platforms have few support personnel or are totally un-manned as they start pumping oil. The compressors on these production platforms have more sophisticated specifications on the instrumentation and the air quality. Oil-free air compressors, for example, are a preference so as to eliminate oil, as a contaminant, which must be removed.

Remote monitoring of the compressors, for these production platforms, is coming in the future. Historically analog gauge controls were a preference because they were simple and could meet electrical classifications easily. It isn't a question of too much technology. We've been on huge ships which are piloted by a small joystick. Deep-water drilling has the technology to go down 8 to 10,000 feet. Remote monitoring provides a significant improvement in reliability while simply requiring considerations for different electrical classifications (for the PLC and the enclosure).



Cold-atmosphere package for instrument air located in Colorado

Where does Tide Air fit within Atlas Copco USA?

The Tide Air Competence Center is located in Houston, Texas, the headquarters of the South Region which is managed by Dave Prator. The South Region is one of four regions, which were created in 2005, as management's response to the tremendous growth we have experienced. "Regionalization" was necessary for Atlas Copco to stay close to the customer and continue to delight him/her.

We used to be structured, in the U.S., with three different divisions (Portable Air, Oil-Free Air, Industrial Air). They had separate teams, reported to centralized management, and used common engineering and customer service resources at headquarters. We now have the Oil-Free and Industrial Air Divisions working within each region, as a team, while Portable Air remains as a separate division.

So regionalization brings better service to the customer?

Absolutely. With regionalization, we now have independent customer service and engineering teams located within each of the four regions. Each region runs an independent business with its own profit statement. The Vice President for a region, like Dave, now lives and works with our customers. We have decentralized management and brought it closer to our customers. We benefit by being able to better understand and service our customers needs, and our customers benefit by being able to communicate more effectively with decision-makers. Decentralized management is also motivated to create local and high quality technical support and customer service.

A big hit with our customers, has been the fact that each region now has a dedicated Customer Center. The four Customer Centers are staffed with warranty claim specialists, technical support people, and credit managers. When a customer calls with a warranty claim, it is handled right then and there by the regional aftermarket team.

The Customer Centers also have "Customer Care" engineers. Their mission is to talk to or visit customers and help solve problems with their compressed air systems. These are fully accredited engineers with extensive training in Atlas Copco products. We sent one of our engineers out, recently, to conduct product training, for a petrochemical plant which had installed an Atlas Copco Variable Speed Compressor, on a platform sixty feet in the air! As you can imagine, these "Customer Care" engineers are very popular with our customers and are always on the road.

Thank you Atlas Copco for your insights.

For more information please contact:

*For US Customers:
Atlas Copco Compressors LLC
800-232-3234
info@atlascopco.compressors-usa.com*

*For Canadian Customers:
Atlas Copco Compressors Canada
800.513.3782
compressors.canada@ca.atlascopco.com*



*Dave Prator, Vice President,
Region South, Atlas Copco USA*

“Tide Air
has served
the oil and
gas industry
for over
thirty years.”

MAINTENANCE

INDUSTRY'S MOST UNDERSTATED ASSET

BY ROY JONES

Maintenance on plant and equipment is a \$600 billion business. Specialists tell us that \$200 billion of that was wasted because of bad maintenance, poor maintenance management (due to misunderstanding or lack of interest) or a combination of both. Regardless of the reason, it will increase costs and reduce product quality and productivity.

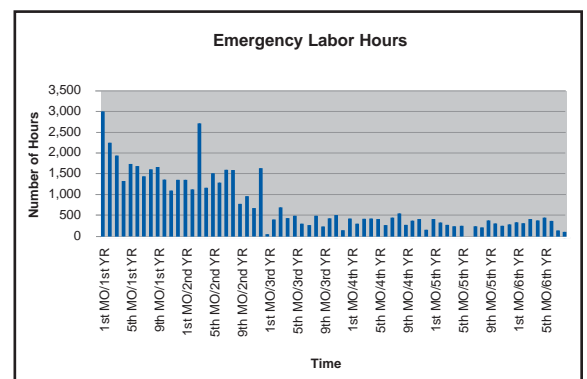
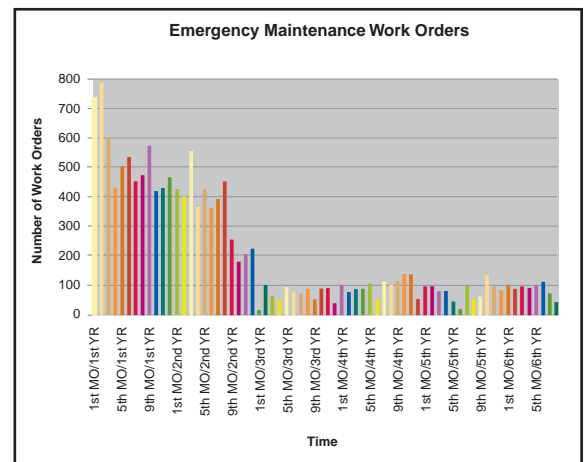
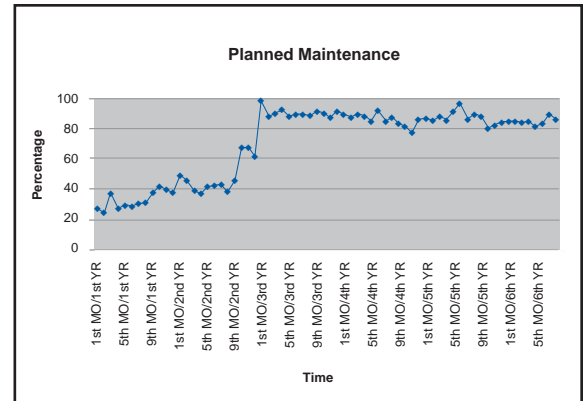
Why is one out of every three dollars spent on maintenance wasted? Without proper management, maintenance has little control or direction except to make repairs when equipment breaks down. Emergency repairs require more manpower than a scheduled repair. Worse yet, many other maintenance-related factors such as lost production time, reduced equipment life, poor product quality and lower profits are often overlooked. These facts show that crisis maintenance is far less efficient than planned or scheduled maintenance.

Maintenance, or maximizing equipment availability and productivity, is nothing new. Ever since man made an effort to sustain the operating condition of his possessions, he has taken care of them — the first attempts at preventive maintenance. These skills were usually handed down from father to son or from master to apprentice.

Breakdown Maintenance

The “fix it when it breaks” or breakdown maintenance, however, became the rule in industry rather than the exception. As long as the maintenance function was seen as a free service by production, there is no incentive to hold down costs with preventive maintenance practices.

To better understand the negative impact of breakdown maintenance, it would be helpful to know how it started. Some maintenance engineers and supervisors were hired or promoted because of their ability to handle crisis situations. They specialized in troubleshooting and were rewarded, unfortunately for the wrong reason — responding to emergency situations. Breakdown maintenance represents one of the most costly and inefficient methods. The question is how can this downward spiral of ineffective activity be reversed?



As shown in these three charts, an increase in planned maintenance dramatically reduces the number of emergency work orders and associated labor expense, adding predictability to the compressed air system and the processes it supports.

Perhaps the largest single factor is to recognize that the problem exists. This can be difficult, especially where breakdown maintenance has always been accepted as normal. Steps should be taken to identify the problems within the maintenance department, estimate the potential savings in terms of higher production, and better utilize personnel and materials. Finally, management must recognize that the conversion to a preventive maintenance program is well worth the investment in money and time.

Incentives for Change

Today's rapid economic growth and changing business conditions have provided new incentives for companies to re-evaluate their maintenance operations. As plants have become more automated, and equipment more sophisticated, the emphasis has switched from merely fixing broken machines to keeping them running efficiently for longer periods of time.

Perceptive management teams recognize that they can no longer be competitive with outdated maintenance practices. The methods, tools and quality of maintenance used in the past are no longer adequate in a contemporary production environment. Good maintenance is a genuine value, especially as it relates to bottom-line results.

Better Maintenance Starts With Better Management

In order to be successful in today's highly competitive economic environment, all profit-conscious companies must initiate a total maintenance management program that will protect and enhance the value of its assets. A primary component of this program is a Work Order Control System to provide the framework and the information to initiate corrective action for problems revealed by a preventive maintenance program.

No maintenance department can operate effectively without an adequate supply of spare parts to complete repairs. Therefore, a Material Control System is essential for a cost-effective spare parts inventory, fully stocked to meet pending needs.

Another essential part of maintenance management is Manpower Control, an effective method of identifying skill or knowledge deficiencies and providing the proper training to overcome them.

A preventive maintenance system should include a well-organized Lubrication Program with the methodology to identify and address potential problems.

The maintenance personnel are entitled to a Safe Working Environment. For a department to provide top-of-the-line service, it must have adequate facilities, equipment and tools to perform its duties, and control expenditures to achieve satisfactory results.

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MAINTENANCE: INDUSTRY'S MOST UNDERSTATED ASSET

Preventive Maintenance. A Change for the Better

Although some form of maintenance is performed by most companies, the systems that control these operations are still somewhat dated when compared to other modern production operations. There is little doubt that maintenance can be a viable source of cost reduction. In many cases, it could increase its value with new methods and technology, improve its efficiency, and become a profit-generating activity.

Preventive maintenance is essentially planned equipment maintenance to prevent deterioration, breakdown, or unscheduled shutdown. The goals include a reduction in equipment failures, a reduction in magnitude of the failures and repair costs, reduced product loss or production downtime, and reducing deterioration in the production capacity of equipment.

The fact is, maintenance must elevate its proficiency to the same level as the production operations it's required to service. This can be achieved by upgrading its organization, establishing budgets and cost-reduction goals, and finding better ways to accurately plan and schedule jobs. Maintenance must rely more on the benefits of failure analysis, systematic lubrication and inventory control associated with good maintenance practices.

Benefits of Preventive Maintenance

- Increase production, reduce downtime
- Reduce the number of major and repetitive repairs
- Provide lower repair cost than breakdown maintenance
- Fewer product rejects
- Better work control and resource utilization
- Better spare parts control/minimum inventory

Predictive Maintenance. New Technologies in Diagnostics

Developed to complement existing preventive maintenance programs, predictive maintenance utilizes the latest analytical techniques to reduce the cost of repair and downtime by identifying potential equipment failures before they occur. Predictive maintenance extends present capabilities by employing new monitoring tools to gather accurate knowledge of machinery conditions without disrupting normal production operations.

Predictive maintenance provides the capability to pinpoint deviations in equipment operating profiles and recognize impending equipment failures. By identifying which parts should be repaired or replaced, it allows continued use of other components, and more time for implementing corrective action. Most important, it provides additional assurance that essential equipment does not fail without warning and ultimately cause a major production disruption or even a catastrophe.

Today's machine condition monitoring techniques are used on sophisticated turbine systems, production machinery, compressed air systems, electrical cabinets, boilers, fans, pumps and valves. Condition monitoring may include identifying problems such as misalignment, imbalance, deteriorating bearings, worn gears or couplings, lack of lubrication, oil deterioration or contamination etc.

Advantages of Predictive Maintenance

Regardless of the condition monitoring technique used in a given situation, maintenance must keep accurate records so it can prove to management that predictive maintenance will:

- Reduce production downtime
- Increase productivity
- Reduce emergencies and breakdowns
- Increase quality
- Reduce excessive equipment damage
- Provide justification for maintenance work and schedules

Predictive Maintenance Technologies

With today's growing want for greater productivity, manufacturing processes and equipment are being subjected to increased demands for additional capacity, testing accepted limitations. As a result, the diagnostic capabilities of predictive maintenance have also increased, opening new areas of responsiveness and diagnostic performance. The following represent some of the most reliable and preferred technologies available for comprehensive analysis.

Lubrication/Oil Analysis

Surveys have shown that over half of all industrial breakdowns are the result of improper lubrication, including under-lubrication, over-lubrication or use of the wrong lubrication. Oil analysis, one of the oldest methods of predictive maintenance, is used to define three basic conditions. These include:

1. condition of the oil
2. condition of the lubrication system
3. the condition of the machine itself

Performed and trended over time, oil analysis can pinpoint improperly performed maintenance, operational practices, and incidents of contamination such as the addition of an improper lubricant.



Fluid analysis programs are designed to evaluate compressor fluids based on the original formulation, consumption patterns and expected life.

MAINTENANCE: INDUSTRY'S MOST UNDERSTATED ASSET

Machine Condition Monitoring

Sound Analysis, one of the oldest and widely employed systems of detecting equipment failure, is best performed on a day-to-day basis by someone familiar with the equipment. Sound analysis is simply detecting something abnormal; if the sound becomes audible, it generally indicates a component is beginning to malfunction and should be further inspected.

Vibration Analysis is often used to determine the operating condition of rotating equipment by identifying potential problems before they cause serious failures and unscheduled downtime. This type of analysis can be used to detect deteriorating or defective bearings, mechanical looseness, and worn or broken gears. It can also pinpoint misalignment or imbalance before it can cause bearing or shaft deterioration.

Ultrasonic Analysis enables technicians to identify and locate such potential problems as bearing deterioration and leaks of compressed air or hydraulic fluid. This type of analysis can also identify poor maintenance practices and machines that are operating beyond their original design limitations.

Thermographic Analysis provides visual images that represent variations in IR radiance of surface objects. This type of analysis has been proven as an effective predictive maintenance tool because mechanical or electrical breakdowns are often preceded by changes in operating temperatures.

Infrared Analysis has the ability to detect an object's IR emissions, and translate into a visual image. It does not have the capability to analyze and quantify specific temperature values.



This hand-held condition monitor trendlines the performance of key compressor components over time to provide advanced indication of equipment failure.

Manufacturers' Support

Manufacturers, equipment distributors, or sales representative of most compressed air systems may provide Service Agreements for new or existing equipment. Depending upon the extent of responsibilities outlined in the agreement, the services provided could allow maintenance personnel to focus entirely on other equipment needs.

Many manufacturers also provide specialized training for maintenance personnel which may be held at dedicated training facilities or at a customer's site. Hands-on training and classroom instruction increase confidence in maintenance personnel.

Tomorrow's Maintenance Management

Highly designed and sophisticated modern machinery will place new demands on maintenance techniques, concepts and philosophy. The idea of "breakdown maintenance" must be eliminated.

The bottom line is to extend equipment reliability. To do this, we must begin using processes of the 21st century: Total Productive Maintenance (TPM). TPM combines preventive and predictive maintenance practices with the concept of total quality control and total employee involvement. The result is a partnership of Operations and Maintenance that has a very real effect on the company's bottom line. Maintain it so well that it will never break.

For additional information, please contact Mr. Roy Jones, Manager, Business Development, Customer Care by Sullair. Telephone: 219-861-5673, email: roy.jones@sullair.com, or visit www.sullair.com.



Service schools are conducted by factory-trained personnel and focus on the proper operation, service and maintenance of compressed air equipment.

INDUSTRY NEWS

Press Releases

PARKER INTRODUCES MODUFLEX DUAL 4-WAY VALVE

Cleveland, Ohio, December 19, 2006 - The Pneumatic Division of Parker Hannifin Corporation (NYSE:PH) announces the addition of a Dual 4-Way Valve to the Moduflex Valves System Series. This valve combines 2, 4-way valves into one valve body. Valve modules can now be ordered as dual valves or single valves.

The Dual 4-way valve module has two independently operated valves in the Size 1 valve body. Though there are two valves in one body, there are no differences in dimensions between double or single valves and there is only a slight reduction in flow when compared to a single 4-way valve.

These valves can be combined with other dual 3-way or single 4-way valves of either Size 1 or Size 2 valves, without transition kits, to fit all types of applications. Moduflex Valves are available in 24vdc solenoid or air pilot operated versions with a universal manual override. The Universal Manual override is available as either Locking / Non-Locking, and can be changed in the field to Non-Locking override only, which helps with machine set-up. When the Locking override is disabled, unwanted locking of the manual override is eliminated.

Moduflex Dual 3-way and 4-way valves offer a flexible automation product for demanding applications. The Moduflex Series provides a complete choice of either stand-alone valves, short-build valve islands, or large valve island configurations.

For more information about the new Parker Moduflex Dual 4-Way Valve, contact Parker Hannifin Corporation, Pneumatic Division. Phone 269-629-5000, email: pdmktg@parker.com or visit us online at www.parker.com/pneumatics.

With annual sales exceeding \$9 billion, Parker Hannifin is the world's leading diversified manufacturer of motion and control technologies and systems, providing precision-engineered solutions for a wide variety of commercial, mobile, industrial and aerospace markets. The company employs more than 57,000 people in 43 countries around the world. Parker has increased its annual dividends paid to shareholders for 50 consecutive years, among the top five longest-running dividend-increase records in the S&P 500 index. For more information, visit the company's web site at www.parker.com, or its investor information site at www.phstock.com.



HITACHI INTRODUCES OIL-FREE ROTARY SCREW AIR COMPRESSOR TECHNOLOGY TO NORTH AMERICA

HITACHI

TARRYTOWN, NY, December 1, 2006 — Hitachi America, Ltd., Industrial Systems Division, today announced introduction of the DSP Oil-free Rotary Screw Air Compressor Technology into North America. Hitachi's 26 years of Oil-free rotary screw and nearly 100 years of compressed air experience lay the foundation for this advanced product series.

Features of the DSP Oil-free Variable Speed and Fixed Speed product portfolio include but are not limited to:

- Patented PTFE-Free coatings to ensure the highest quality air is provided to the end user.
- Stainless steel rotors on both the 1st and 2nd stage rotors.
- Patented Hi-Precooler to provide efficient cooling and thermal protection.
- Patented Oil Mist Remover to prevent oil mists from venting to atmosphere.
- Patented rotor clearance design to provide greater efficiency and higher airend reliability.
- Patented "PQ Wide Mode" speed adjustment design to provide greater air output at lower pressure settings.
- Industry leading low sound levels and vibration isolation.
- Incorporation of Hitachi motors, inverter drives and airends to convey highest efficiencies throughout the operating range.

Hitachi's DSP Oil-free rotary screw air compressor products are part of the Air Technology Group, which is based in Charlotte, NC. The facility will be the center for all Air Technology Group business operations, warehousing, and training for Distribution Partners and OEMs.

For more information, please visit www.hitachi.us or contact airtechinfo@hal.hitachi.com.

Hitachi America, Ltd., a subsidiary of Hitachi, Ltd., markets and manufactures a broad range of electronics, computer systems and products, and consumer electronics, and provides industrial equipment and services throughout North America. For more information, visit <http://www.hitachi.us>.

Hitachi, Ltd., (NYSE: HIT / TSE: 6501), headquartered in Tokyo, Japan, is a leading global electronics company with approximately 356,000 employees worldwide. Fiscal 2005 (ended March 31, 2006) consolidated sales totaled 9,464 billion yen (\$80.9 billion). The company offers a wide range of systems, products and services in market sectors including information systems, electronic devices, power and industrial systems, consumer products, materials and financial services. For more information on Hitachi, please visit the company's website at <http://www.hitachi.com>.



INDUSTRY NEWS

Press Releases

FREE AIR SYSTEM GUIDE!

Start Saving Energy Now with Your Compressed Air System

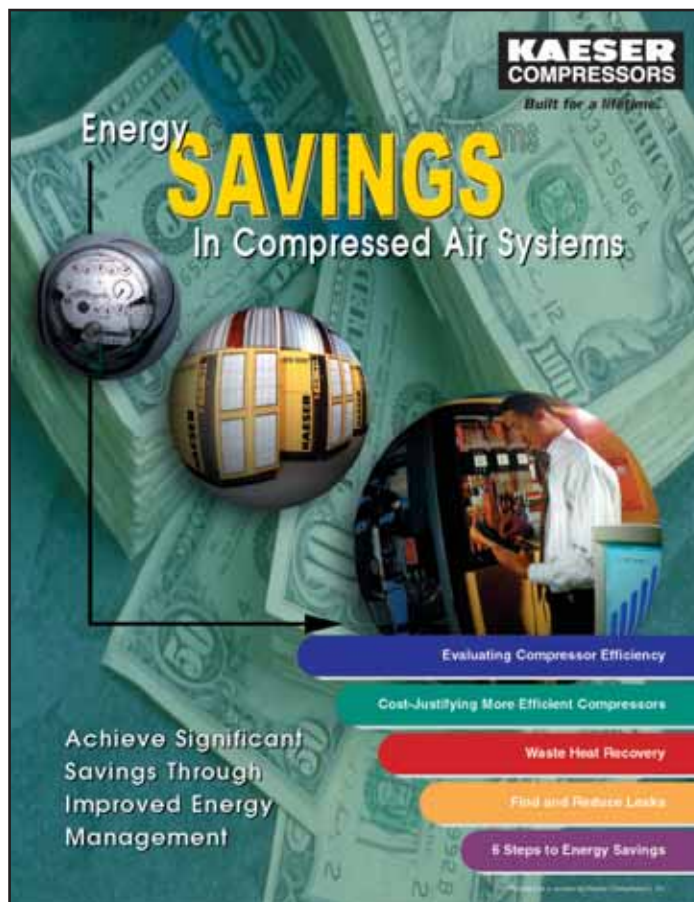
**KAESER
COMPRESSORS**

Built for a lifetime.™

Available from Kaeser Compressors, Inc. — Energy Savings in Compressed Air Systems Guide. This free resource explains the various factors that greatly impact compressed air system performance, and outlines easy steps to dramatically increase the efficiency of existing systems.

With details on understanding and measuring the complete cost of generating compressed air, this guide demonstrates that in 125 hp applications, the annual cost of electrical power to drive compressors can be twice the cost of the compressor itself. Find out why compressed air is often referred to as “the fourth utility”. Check out the formulas for estimating the real cost of compressed air leaks. Learn how you can optimize air system performance and save thousands in electrical power costs!

For a complimentary copy of this four color, eight-page guide, call 800-777-7873 or visit us at www.kaeser.com.



COMPAIR RECOGNIZED AS AN OUTSTANDING SUCCESS



Leading global manufacturer, CompAir, has been awarded 'Private Company Turnaround of the Year 2006' by the Society of Turnaround Professionals (STP).

The company, headquartered in the UK, was presented the award at a prestigious ceremony recognizing the outstanding contribution to the UK economy of the country's top corporate trouble shooters.

CompAirUSA, the North American division of CompAir, operates locally in Sidney, Ohio.

A panel of ten independent judges from the UK business community selected CompAir from a number of submissions, describing what the company has achieved over the last four years as "an outstanding turnaround."

CompAir is one of the world's leading manufacturers of compressed air and gas systems. Its compressors, equipment and services are in use across the globe in a wide variety of industrial applications.

In the four years since its CEO Nick Sanders arrived at the company, it has seen unprecedented growth and success. The company has been guided away from financial troubles and is now recognized as a top UK manufacturer, achieving double digit growth, putting it well ahead of the market rate.

Mr. Sanders was presented with the award by Hamish McRae, associate editor of *The Independent* and principal economic commentator for *The Independent* and *The Independent on Sunday*, in front of more than 300 business leaders.

Mr. Sanders commented:

"This is a very important award for CompAir and to receive this kind of recognition reflects just how far we have come in the last four years. This is only one step on our journey and we will be redoubling our efforts to ensure not only the continued success of CompAir, but further recognition of UK industry's contribution to the global marketplace."

Nick Ferguson, chief executive of STP, said: "The awards enable the turnaround profession to be openly recognized for saving businesses and acknowledged amongst the wider business community as being an intrinsic part of commercial and public life — in the same way that the accounting, legal and management professions have long been regarded."

STP was established in 2000 as an independent body for turnaround professionals, including independent executives, accountancy and legal advisers and stakeholder representatives. STP is supported by the UK Government, the clearing banks and other financiers, private equity investors and leading accountancy firms with the aim of ensuring that the highest standards of ethics, behavior and quality are observed and adhered to by its members and the turnaround profession.

For more information about CompAir call 937-498-2500 or visit www.CompAir.com

INDUSTRY NEWS

Press Releases

NEW AIR SERVICES FROM FESTO

Air Quality Service



Is Your Air Clean? Let Festo help you find out. . .

Contaminated compressed air can be costly. Increased maintenance costs, reduced service life of pneumatic components and loss of production are some of the more common consequences. Foreign particles, too much residual moisture or oil in the compressed air lines are some of the potential problem factors, causing blockage, increased friction, excess wear, unnecessary leaks, lubricant wash outs, and malfunctions. Festo now offers customers a new service package which prevents damage of this type.

Air Quality Service from Festo helps to systematically prevent damage caused as a result of contaminated compressed air lines to ensure optimal operation of the pneumatic systems.

A compressed air quality analysis supplies all the data you need, either before putting new equipment into service or on a regular basis as part of a service contract. This analysis can also help to determine the reason why a component may not be functioning as expected.

Festo Air Quality Service includes:

- Inspection of remote air preparation devices at the point of consumption
- Inspection and analysis of installed components
- Measurement of residual oil content (to ISO 8573 class 2)
- Measurement of pressure dew point (to ISO 8573 class 2)
- Development of measures for improvements

For more details, please visit: www.festo.com/us/airservices/FAQA

Festo is a leading global manufacturer of pneumatic and electromechanical systems, components and controls for industrial automation, with 56 national headquarters serving more than 180 countries. For more than 80 years, Festo has continuously elevated the state of manufacturing with innovations and optimized motion control solutions that deliver higher performance, more profitable automated manufacturing and processing equipment. Our dedication to the advancement of automation extends beyond technology to the education of current and future automation and robotics designers with simulation tools, teaching programs, and on-site services.



FIFO TECHNOLOGIES LAUNCHES INNOVATIVE STRIPPER WELL OIL RECOVERY SYSTEM



October 16, 2006 — Bellevue, WA — Data-Linc Group along with Rockwell Automation has been selected by Fifo Technologies, Inc. to create a wireless SCADA system for Fifo's innovative stripper well recovery system. Fifo Technologies provides the well head equipment, Rockwell the Micrologix 1100 PLCs, drives, Panelviews and RSLinx/ RSView software and Data-Linc provides the economical, high performance PLR5000 900MHz Frequency Hopping Spread Spectrum modems for highly reliable monitoring and control of Fifo's equipment and the oil wells' performance.

Charles Ice, founder of Fifo Technologies, recognized the significant energy resources available from abandoned oil wells in the US. Literally hundreds of thousands of wells are inactive due to historical low price of oil and high cost of jack pump systems. Charles saw an opportunity to develop a low-cost alternative to the traditional jack pump.

A low cost pumping system is a key technology for low-yield wells with reliable communications essential for both pump controls and for recording the amount of oil extracted (critical for royalty contract and regulatory compliance). Eliminating cables as the communication link from well pumps to storage tanks and then on to the administrative office made the wireless pumping system even more economical. Because he needed not only very reliable wireless data transfer but also a small form factor to meet his packaging needs, he chose Data-Linc because of their product options, form factor, support and because the radios "simply work."

Because both the distributor, Reynolds, and Data-Linc are Rockwell Encompass partners, all the major components could be purchased from one source with local support. And because Data-Linc modems have been tested for compatibility with Rockwell equipment and because Data-Linc factory configures its modems for each application, seamless operation with the interfacing equipment was ensured. This was a major factor in choosing Rockwell components for the system (MicroLogix 1100, PanelView and Drive system) and Data-Linc wireless products (PlantLinc 5000 Wireless Serial Modem).

Each Remote PLR5000 connects to a Rockwell Micrologix 1100 PLC which has a hard wire connection to the Fifo enclosure and provides local monitoring and control of the well and production equipment. The Repeater is battery powered for convenient and economical positioning. The Master PLR5000 connects serially to a computer running RSLinx and RSView for real time monitoring. The entire system is easily deployed and standardized for straight-forward and low cost operation for all Fifo's sites.

The first group of systems have been installed and are performing beyond expectations. Fifo is forecasting sales of at least 5,000 of the pump stations over the next three years.

For more information contact Data-Linc at: tel: 425-882-2206, email: info@data-linc.com, www.data-linc.com

About Data-Linc Group Since 1988, Data-Linc Group has been the leading provider of industrial data communication solutions. Data-Linc designs and manufactures high performance, superior quality modems for a broad range of industrial applications. Their complete line of industrial grade modems and networking products consistently provide reliable, robust data communications even in the most demanding environments. Data-Linc Group, an alliance partner with most major PLC manufacturers including Rockwell Automation, provides expert technical support and communications consultation. Data-Linc's industry proven RF technology has been successfully implemented in all major industries including automotive plants, consumer goods manufacturing/packaging, steel mills, mines, oil/gas refineries, paper mills, utilities and transportation systems, as well as in the instrumentation industry. With its line of wireless modems for the European Union, Data-Linc's products and support are available worldwide. All Data-Linc products provide field proven performance and come with industrial grade support. For more information, please contact us via, visit www.data-linc.com or call (425) 882-2206 Pacific Coast Time.

About Fifo Technologies, Inc. Fifo Technologies, Inc. provides new technologies to the marginal or "Stripper" oil well industry. Fifo accomplishes this with the use of decades of engineering experience and manufacturing using state of the art materials and components. Fifo Technologies is committed to the industry and to its customers to provide the best and most profitable solutions to the marginal oil well business.

About Rockwell Automation Rockwell Automation (NYSE: ROK), is a leading global provider of automation, power, control, and information systems and services that help manufacturers achieve a competitive advantage in their businesses. Headquartered in Milwaukee, Wis., the company employs about 21,000 people serving customers in more than 80 countries.

JOB MARKET

Job Openings in the Compressed Air Industry

GRS · GRS FLUID HANDLING

REGIONAL SALES MANAGER — CALIFORNIA

GRS Fluid Handling is working on a search for a client of ours — a strong compressor manufacturer, serving a variety of industries worldwide. They are a strong company with a track record of customer satisfaction. This position, as a Regional Sales Manager, will sell Industrial Air Compressors throughout a California territory.

Requirements:

- 2-5 years sales experience; ***Must have channel management experience
- Knowledge of California account base as well as surrounding areas
- Some applications experience, preferably dealing with compressed air systems
- A strong personality and attitude
- A college degree is strongly preferred for this position.

This is a highly visible position that offers a chance for advancement, great benefits, challenge and opportunities with a strong, stable company.

SALES POSITION — NORTHERN FLORIDA

GRS Fluid Handling is working on a search for a leader in the compressor industry. Their presence in Florida makes them one of the strongest companies in compressed air, with strong product offerings and great service. This position, in sales, will be responsible for targeting potential OEM customers and introducing product to new markets.

Requirements:

- Knowledge of compressed air products and systems
- 3-7 years Outside Sales experience
- Strong sales presence, and the ability to make large scale sales
- Ambition to succeed and desire to bring solutions to industrial businesses
- Residence or relocation in Northern Florida

Along with being in a beautiful location, this position offers daily challenges and strong company support. It interacts with sales, marketing, and engineering, and offers the chance to progress in a company that rewards excellence.

For more information on these positions, any other positions we are working on, or to learn more about GRS and GRS Fluid Handling's recruiting services please send an e-mail to us at cabc@grsrecruiting.com.



6690 Beta Drive • Mayfield Village, OH • (440) 684-6150 • cabc@grsrecruiting.com
www.grsfluidhandling.com

Compressed Air Best Practices

JOB MARKET ADVERTISING RATES

MAGAZINE ADS

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

1x per year: \$94.00*
per column inch

3x per year: \$90.00*
(i.e., this is a 10 col. inch, reversed ad)

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

ONLINE ONLY ADS

Each job posting is up on the site for 60 days. Postings can be purchased in bulk quantities per the rates below. The customer has twelve months to put the postings on the site. After twelve months, any unused postings will be charged at the minimum quantity.

Small Qty.	Price Per Posting	Bulk Qty.	Price Per Posting
1	\$250	5-9	\$185
2	230	10-24	170
3	210	25-49	150
4	195	50+	135

patricia@airbestpractices.com,
tel: 251-510-2598



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Certified Management Systems

