

A PUBLICATION OF THE DRESSER-RAND COMPANY

# insights

FOURTH QUARTER 1998

Featured in this issue  
of *insights*:

Team Approach Delivers  
Results For TransCanada  
Pipelines Ltd

Dresser-Rand And  
Kvaerner Form Venture  
To Introduce Biphasic  
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Dresser-Rand To Power  
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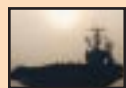
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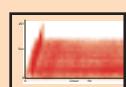
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## Mergers, Changes Expand Breadth, Depth To Clients

As we prepare to close out the last of the 20th century, it is time to address the changes of the past year for Dresser-Rand and discuss what they may mean to our valued friends.

There is an aura of excitement at Dresser-Rand as we begin 1999. The excitement is akin to some of the early oil discoveries of the 19th century. Our company and its forebears have been serving the industry for more than 100 years. We have weathered all of the transitions and changes (some of them monumental) to evolve into a very strong company, a leader in our businesses and a powerful competitor on any front.

Our industry position is by design, not happenstance. For example, in 1987 Dresser Industries and Ingersoll-Rand gathered their like businesses and formed the partnership that is now Dresser-Rand. The strong became stronger, and our clients benefited from the synergy.

Eleven years later, Dresser Industries merged with the Halliburton Company — both based in Dallas.

The Halliburton and Dresser merger in accounting terms is a "pooling of interests." That term also serves to define what the merger means: we're pooling our interests to perform better in the market place, which will result in better service and better products for clients.

# candid visions

The trend in the oil industry is toward larger and more resourceful organizations. Recently, three major oil company mergers were announced: Exxon and Mobil; British Petroleum and Amoco; and Total S.A. of France and Petrofina S.A. of Belgium. They are awaiting regulatory approvals.

On the Halliburton and Dresser merger, the idea is to create a larger, more sophisticated entity with the expanded ability to deliver high quality, highly engineered goods and services. An example of this can be found in Kellogg Brown & Root. Before the merger there was Dresser's M.W. Kellogg engineering and construction services, and Halliburton's Brown & Root project management and construction arm. Dresser-Rand in the past had worked closely with Kellogg on a variety of major projects. Now Dresser-Rand can draw from the expanded expertise and skills of Kellogg Brown & Root. These advantages to us accrue to our clients.

In business, good fortune is by design.

Another design also occurs in 1999, corporate correspondence with Dresser-Rand changes its address. We will be relocating our corporate headquarters from Corning, New York, to Houston, Texas. This places our 40-person headquarters unit in this country's energy headquarters. (See page 4.)

We will maintain our large manufacturing operations where they are, which is mostly in the Southern Tier area of New York State — close to Pennsylvania where the world first drilled for oil in the 19th century.

Changes for the better occurred in 1998 for Dresser-Rand. While clients may not notice much difference this month in doing business with us, by the end of the year we think business with Dresser-Rand will be more productive and more profitable for our clients and for us. ■

Dave Norton  
President and CEO  
Dresser-Rand Company

# Team Approach Delivers Results For TransCanada Pipelines Ltd.

When Station 211C on the TransCanada PipeLines went into operation last October, it represented more than just one of the company's most advanced transmission stations. The team completed the project under budget and on time, but also achieved a number of first-time technical accomplishments for the company.

Located in Beamsville, Ontario, about 40 kilometers west of Niagara Falls, Station 211C is responsible for distributing natural gas to utilities in the northeastern United States. Increasing demand from these customers, and existing contract commitments by TransCanada, necessitated the construction of the new facility.

The gas originates from the Great Lakes system, through Union Gas Company at

Sarnia, Ontario, and is transferred to TransCanada at Kirkwall, Ontario (near Cambridge). The gas is shipped down the 200-2 line through Station 211 on the Niagara peninsula, and off to two streams. The first stream goes to Tennessee Gas Transmission, while the second stream is further pressurized at Station 1703 for delivery to the Empire State Pipeline.

In June 1996, Steve Wright, who was new to TransCanada, was assigned the task of bringing Station 211C to reality. As project manager, he was responsible for preparing the initial layouts for engineering purchases as well as assessing the bids for equipment procurement.

While the new station immediately would become one of the largest flow and horsepower stations in the Eastern TransCanada PipeLines system, an additional challenge was to design it to accommodate

future increased requirements. "At this point in the maturity of the system, equipment is being retired and replaced with new technologies to better meet our customers' demand," said Wright.

"Our first step was to establish Present Life Worth calculations and Total Life Cost estimates," Wright added. "The facility would be required to operate for at least 25 years, with additional productivity demands in the future. We set out to build the most serviceable and quiet station we could design."

## Selecting the Right Team

Because this was Wright's first project for TCPL, he felt it was critical to select a team that could work well together. In addition to Wright, Dave Hammill served as the construction manager for TCPL. Together they assembled a group of vendors that would add value to the project in the form of technical expertise as well as reflect personal styles that fit their own.

Dresser-Rand was selected to provide compression equipment for the project, and Solar gas turbine packages were chosen to drive the equipment.

"Reliability and availability were big determining factors in our selection of machines," said Wright. "TCPL's delivery record is excellent and we place a high priority on maintaining that good reputation."

A critical aspect of the compression equipment selection was obtaining sufficient flow capacity for current as well as future requirements. "TCPL had originally inquired basis a 50 PDI compressor, but we found out early in discussions that for their long-term purposes they would need a larger case volume for high flow and low head capacity," said Arnie Larsen, project engineer for Dresser-Rand on the Station 211C project. "We ended up designing a 60 PDI unit with 50 PDI internals. This allowed us to achieve the future higher flow while matching the Solar Mars unit which has a design speed of 9500 RPM."

Even with over 280 units on the TransCanada PipeLines system, this was the company's first 60 PDI

machine. "Dresser-Rand has been providing compression equipment and gas turbine packages to TCPL since 1948, but this was our largest capacity unit to date," Larsen added.

The Solar Mars turbine is a 15,000 horsepower unit equipped with Dry Low Emission (DLE) combustion systems to comply with increasingly tough air quality standards in Canada.

### A Quiet Success

Other firsts for TCPL came in the form of station construction and noise reduction. The Ontario Ministry of Regulations has strict standards for noise emissions, and compliance was fundamental to the project. "We were committed to achieving very rigorous noise reduction levels at this facility," said Wright. "Rather than individually enclosing the compressor train, we opted for a fully acoustic-controlled building, with some of the components – such as the lubricating oil system – located outside of the structure. This also allowed us to maintain more space inside for accessibility and maintenance."

In addition to the acoustically enclosed structure, TCPL also jacketed the piping with acoustical protective material and kept most of the lines underground. The overall noise emissions of the station meet the requirements for noise levels for the installation of 36 decibel at 100 meters. "The station is so quiet, that if you get out of your car at the gate and listen, you can't tell if it's running or not," Wright says.

The added noise reduction measures led to other technical challenges, as well. "This is a direct lock mounted compressor which is fairly stiff, so pipe strain issues had to be considered," said Wright.

The team satisfactorily addressed these technical issues. "We considered the pipe strain constraints imposed by the station piping configuration," said Larsen. "The inherent rugged design of the cast 60 PDI casing handled the loads, however, without compromising mechanical integrity".

Currently, Station 211C transmits 10.13 cubic meters of gas per second under actual conditions, at a suction pressure of 695 psi to 850 psi discharge. The 60 PDI

compressor is arranged in series with an existing high-pressure Solar Mars C601 machine. "Because it is a single line, we designed the units in series to achieve maximum pressure," added Wright.

"This was the first time that the team consisting of myself, Dave Hammill, Arnie Larsen of Dresser-Rand, and Islwyn Davis of Solar have worked

together on a project," said Wright. "I believe it was the ability of this team to work well together that allowed us to meet our objectives and bring the station in on time and under budget. Any difficulties we encountered were handled openly through good communication, with no hidden agendas. Successful projects like this one are built around people and relationships." ■



*TransCanada Pipelines' Station 211C is located in Beamsville, Ontario, approximately 40 kilometers west of Niagara Falls.*

# Dresser-Rand Company Relocates Headquarters To Houston

CORNING, New York - Dresser-Rand Company has announced that it will relocate its headquarters to Houston, Texas, January 1999. Corning, New York has been the company's headquarters since the Dresser-Rand partnership was formed in 1987.

The move from the current headquarters is a deliberate, well thought out strategic move advancing the mission of the company. Dresser-Rand is now implementing strategic plans that will allow it to provide energy conversion solutions by broadening its worldwide leadership role in the manufacturing of essential equipment and by providing specialized services for the oil and gas, petrochemical and power generation industries.

"Dresser-Rand is focused on increasing its emphasis on providing integrated energy conversion solutions," said David Norton, president and chief executive officer of Dresser-Rand. The company is expanding its capabilities for the engineering - design, construction, management and operations of major installations at oil and gas fields around the world. "This requires a commitment to focus on the needs of clients, helping them to achieve their strategic business goals. Since many of our company's North American-based clients have headquarters or major installations in the Gulf Coast region, Houston is an ideal location for Dresser-Rand's headquarters."

In addition, the headquarters for Dresser-Rand Services also will move from Corning to Houston. Dresser-Rand currently has operations including its control systems and its worldwide sales organization headquarters in Houston.

"From Houston, one of the energy capitals of the world, we can better serve our clients, understand their needs, and better direct the growth of Dresser-Rand," Norton said.

The move only affects Dresser-Rand's company headquarters and its Services headquarters, both located at 1 Baron Steuben Place, Corning. It does not affect the

operations at its manufacturing facilities in Painted Post, Wellsville, and Olean, New York. "Dresser-Rand has been and will continue to be dedicated to the Southern Tier of New York State," stated Norton. "The company has significant investment in its three manufacturing plants, and they remain a key part of our growth strategy."

Dresser-Rand employs 40 people at its Corning location. Half of those will continue in their present positions in the Corning/Painted Post area, and approximately one-third will be offered positions in Houston.

Additional information about Dresser-Rand Company can be found on the company's web site at [www.dresser-rand.com](http://www.dresser-rand.com). Information about the Halliburton Company and Ingersoll-Rand can be found at their respective web sites, <http://www.halliburton.com> and <http://www.ingersoll-rand.com>. ■

# Dresser-Rand Offers Vertical Rotor Storage, Providing 24-Hour Turnaround To Operators

With refineries and other petrochemical processors interested in faster turnaround for critical equipment, Dresser-Rand Company has begun a vertical storage program that can have spare rotors inspected, delivered and ready for installation in 24 hours.

"We had provided various forms of storage over the years in certain Service Centers, but we are now marketing a Rotor Storage Program as a global service," said Mike Keator, Marketing Manager for Repair Operations. "Clients choose Dresser-Rand's Rotor Storage Program based on our position as a leading manufacturer of rotating equipment and our record of service reliability."

Clients now can have their spare rotating assembly check balanced and delivered for installation usually within 24 hours. Other major advantages include:

- Safe, secure vertical storage with custom fitted hanging fixture to prevent shaft bowing;
- Complete inspection, rotor preparation and repair service;
- Storage in a climate-controlled environment to prevent corrosion and to eliminate the need for a heavy preservative coating;
- Multiple locations to reduce delivery time and shipping costs.

Dresser-Rand now offers rotor storage in Chicago, Philadelphia, Cincinnati, Los Angeles, Houston, Baton Rouge, and Tulsa. Dresser-Rand's operation in Wythenshawe, England, has been providing vertical rotor storage for several years to accommodate needs of European clients. In Aberdeen, Scotland, rotors are stored in containers for offshore operations in the North Sea.

"We will continue to review worldwide expansion of this program to service the needs of our clients," notes Keator.

Improved technology, increased safety awareness, as well as EPA, ISO and API requirements are forcing equipment owners to review more closely their critical equipment repairs and inspections. "Documentation is required to validate rotor repairs and integrity changes since the last inspections, and Dresser-Rand's Rotor Storage Program provides all that."

Storing rotors at Dresser-Rand reduces clients' storage and maintenance requirements by freeing warehouse space, improving manpower utilization, and transferring responsibility for storage documentation control to Dresser-Rand.

Dresser-Rand's storage facilities feature a climate-controlled environment to prevent corrosion and vertical hanging to eliminate shaft bowing. All rotors are visually inspected to detect physical abnormalities specially prepared for storage. Prior to shipment rotor balance is checked to maintain sound rotor installation and reliable operation.

Dresser-Rand operates 12 Service Centers in the United States, two in the United Kingdom, and one each in Canada, France, Germany, Italy, Netherlands, Singapore, and Venezuela. Through this network of Service Centers, Dresser-Rand is available 24 hours a day anywhere in the world to keep clients' equipment available. ■

# Multiphase Pumping Increases Oil Production While Reducing Costs At The Wellhead

*By Roger Hartt,  
Ingersoll-Dresser  
Pump Company,  
Brantford Business Unit*

In man's pursuit of oil, he has encountered many products and substances that challenge the cost-effectiveness of the exploration, development and transportation of petroleum products. The quality of the product at the oil wellhead varies considerably with the content of gas, water, oil, and solids such as sand. In addition, paraffins and hydrates further complicate the handling of the product stream.

Traditionally, the product is taken from the well and processed through separation units that separate the liquid from the gas products. These products are then transported in separate pipelines, using compressors for the gas portion and centrifugal, rotary or plunger pumps for the liquid products. It was found that within the rotary family of pumps, the two screw pump design could handle mixtures

of the liquids, gases and solids. The process of pumping of these combined products came to be known as multiphase pumping. By eliminating the capital cost of the separation equipment and a second pipeline, the return on investment for the owner is significantly increased.

## Multiphase pumping offers other significant advantages

On low gas percentage applications, the user often "flares-off" the unwanted gas stream to avoid the cost of an additional pipeline to transport it. This is harmful to the environment, and wastes energy.

Oil wells most often lack sufficient pressure within the formation to move the products to the surface. Multiphase pumps are capable of lowering back pressure on the well, which increases the production rate and can also lead to greater mean times between repairs on the down hole pumps, when used.

Boosting pipeline pressure will help reduce hydrate and paraffin formation in the pipeline, thereby reducing pipeline maintenance and heat tracing of equipment.

## Why use two screw pumps?

Two screw rotary pumps are able to handle 100 percent slugging (either fluid or gas) which is a common occurrence with oil reservoirs. This is possible because two screw pumps develop pressure hydrostatically and therefore do not depend on the pump speed or fluid density to maintain a constant pressure. When slugging does occur, the differential pressure remains constant (with a reduced output) and torque is relatively unaffected.

Other pump types used in multiphase pumping are progressive cavity and rotodynamic. While each of these types has a place within this market, none are as versatile in handling the full range of conditions as is the two screw design.

## A Product of Evolution

In 1989, Ingersoll-Dresser Pump Company (IDP), along with other major suppliers from around the globe met with ESSO and Exxon. At this workshop the validity of multiphase pumping came a step closer to reality. Since that time, IDP has carried out extensive testing at our factory in Brantford, Ontario, and at Texaco's Multiphase Facility near Houston.

Our product development has included many visits to the oil patch. We have received excellent feedback from the process designers through the operators. This has allowed us to continually evolve to a design that provides high reliability and ease of maintenance when needed.

Ingersoll-Dresser Pump Company's Brantford Business Unit, and IDP Corporate Technology are continually advancing multiphase two screw pump technology through improvements in materials, hydraulics



optimization, and Finite Element Analysis of major components. A sub-sea design coupled with technology from IDP Pleuger and SubSea Offshore Ltd. (a Halliburton Company) is currently underway for a project off of the coast of Africa. This concept was presented in a technical paper at the Offshore Technology Conference in Houston this year.

IDP is committed to market leadership in two screw multiphase pumping by being customer focused and driven by technology leadership. With the breadth of expertise of IDP and our parents, Ingersoll-Rand and the Halliburton Company, we can effectively serve customers around the world.

#### Installed Units

In October 1996 we installed a model MP1-125 with Pan Canadian in Alberta Canada. Trinmar in Trinidad received two standard units in early 1997. Shell Canada installed two pumps in June of 1998. We are currently producing duplicate pumps for both Pan Canadian and Shell Canada.

BUNDUO Petroleum chose IDP for the first multiphase pump to be installed in the Middle East. This unit with electric motor, VSD, and

controls, will be installed on a production platform. This is a large pump with double cartridge mechanical seals. The double mechanical seals are required due to the hazardous nature of the gas. IDP was selected because of our flexibility to provide this feature. The unit was shipped in October of 1998.

We are also working with an IDP distributor, Smith Cameron, and their customer, Lourne's Oilfield Products, who packages oilfield equipment. They have three years experience with multiphase pumping, and have chosen to promote and use IDP multiphase pumps. Lourne's has just commissioned their first MP1-125 and through Smith Cameron ordered two more units.

#### Summary

Multiphase pumping provides tremendous opportunities for oil companies, large and small. Ingersoll-Dresser Pumps, is uniquely positioned to meet our customers' needs through our leadership in technologies such as Multiphase pumping, as well as our manufacturing capabilities, and global sales and aftermarket support network.



#### Editor's Note:

*Ingersoll-Dresser Pump Company (IDP) is a joint venture of Ingersoll-Rand and Halliburton Company. IDP, based in Liberty Corner, New Jersey, is a leading manufacturer of pumps and systems for diversified industrial applications, including: oil and*

*gas production; power generation; naval/marine; pulp and paper; hydrocarbon and chemical processing; pipeline; primary metals; water and wastewater management; mining; food processing; agriculture; and general industry. ■*

# Dresser Pumps

# Dresser-Rand And Kvaerner Form Venture To Introduce Biphase Technology

WELLSVILLE, New York – Dresser-Rand Company and Kvaerner U.S. Inc., announced the formation of Multiphase Power and Processing Technologies LLC (MPP Technologies LLC), to develop and market proprietary expanders and other equipment to separate gas and liquids and to generate power from previously wasted energy during oil production.

The equipment will enable oil and gas producers to reduce the size of the production platforms and subsea modules, and to generate power needed for production with no greenhouse emissions.

The equipment is based on Biphase turbine technology, which has been acquired from Douglas Energy Company of Placentia,

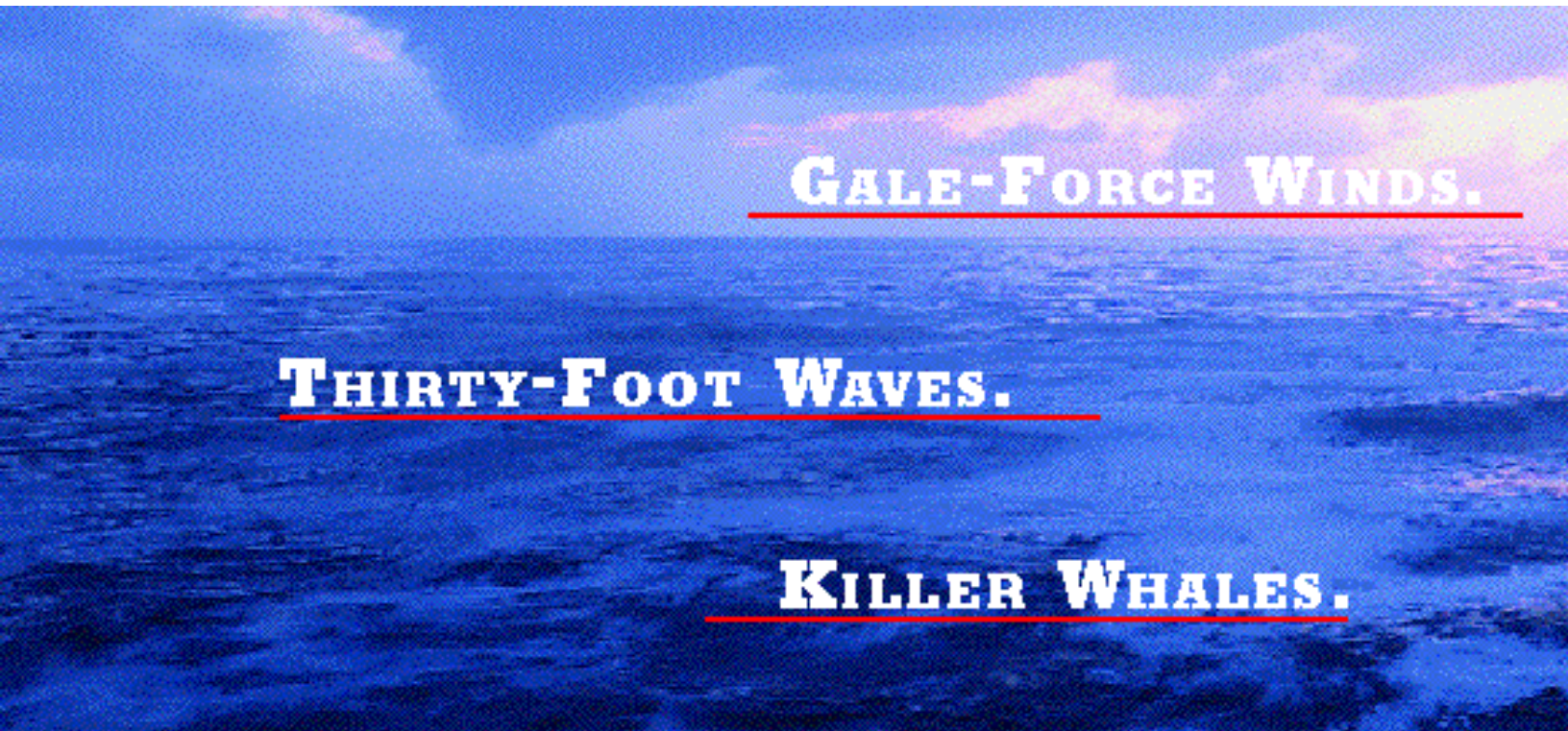
California. Douglas Energy will work with Dresser-Rand and Kvaerner in the further development, demonstration and commercialization of the technology.

"This venture links the complementary strengths of Dresser-Rand and Kvaerner by combining Kvaerner's unparalleled expertise in separation technology with Dresser-Rand's world class machinery design and manufacturing capability," said Dennis D. Weimer, president of Dresser-Rand Energy Systems. "The benefits to our clients include cleaner, more compact systems, as well as the potential reduction in capital equipment costs."

Arnfinn Unum, president of Kvaerner U.S. Inc., emphasized the future potential of the venture. "We are delighted that Kvaerner and Dresser-Rand have teamed up to form a company that will undoubtedly accelerate the introduction of these exciting new products into the market," Unum said. "The clear synergies which exist between Kvaerner U.S. and Dresser Rand should be of great value to our customers."

## MPP Technologies Appoints President

Dresser-Rand has announced that John A. Gegus has been named President of Multiphase Power and Processing Technologies LLC (MPP Technologies).



**GALE-FORCE WINDS.**

**THIRTY-FOOT WAVES.**

**KILLER WHALES.**

Dresser-Rand turbomachinery has always felt right at home in the world's toughest locations. After all, we factor reliability into our design, manufacturing, fabrication, packaging, installation and operating processes. We have been building turbomachinery for over 60 years—and with our worldwide operating experience as a resource, you can be sure you'll get a compression system



*John A. Gegus*

In his new position, Gegus will be responsible for directing the operations of MPP Technologies, a venture formed by Dresser-Rand Company and Kvaerner U.S. Inc., as it develops and markets equipment based on the Biphase turbine technology, which has been acquired by MPP Technologies LLC.

Gegus has been employed with Dresser-Rand since 1980, holding a number of executive management positions, most recently as Vice President, Business Development at the Dresser-Rand Energy Systems operation in Wellsville, New York. In his new role as President of MPP Technologies LLC, Gegus will continue to work from Dresser-Rand in Wellsville.

Gegus is a graduate of Michigan State University where he received a Bachelor of Science degree in chemical engineering. He also received a master's degree in business administration from the University of California at Los Angeles.

While the Biphase technology has already been tested in the field, the formation of this LLC will rapidly expand its application in the oil and gas industries. "We are gratified to see our technology transferred to two such outstanding companies," said Lance Hays, president of Douglas Energy, the engineering company that has developed the Biphase technology. "The Biphase turbine has already been commercialized in refrigeration systems and for geothermal power production. No other companies possess the ability of Dresser-Rand and Kvaerner to commercialize this technology in the oil and gas sector."

Kvaerner U.S. Inc., is a member of the Kvaerner Oil and Gas group of the Anglo Norwegian international engineering and construction group, Kvaerner ASA. KPS, with headquarters in Oslo, Norway, is a leading international supplier of process systems and complete process trains for offshore and onshore oil and gas production. Systems have been supplied for such duties as oil, gas and water separation; gas treatment and conditioning; water treatment; and utility systems. Additional information on Kvaerner can be found on the company's web site [www.kvaerner.com](http://www.kvaerner.com). ■

**Another great place for our turbomachinery.**

that works. So whether you're in gas gathering, gas lift, reinjection, storage or boosting, choose Dresser-Rand. Because while our turbomachinery operates in tough spots, it will never leave you in one. For more information, visit [www.dresser-rand.com](http://www.dresser-rand.com).

**DRESSER-RAND**



Statoil, Norway's largest oil and gas company, put turbomachinery to work in the North Sea.

# Dresser-Rand To Power Carrier, Strengthening Navy Commitment

Dresser-Rand's Energy Systems operation is expanding its steam turbine business with the U.S. Navy, embarking on a program to supply main propulsion steam turbines for the next nuclear reactor-powered aircraft carrier now being planned for the country's fleet.

Dresser-Rand has been a major supplier of naval auxiliary steam turbines (Terry, Worthington, Turbodyne and Dresser-Rand trade names) since World War I. The new venture, however, provides the company's first main propulsion steam turbines for the Navy. The company acquired the General Electric Naval Steam Turbine business based in Fitchburg, Mass., in 1996, according to Philip J. Hoffmann, Vice President of Project Management at Energy Systems in Wellsville, New York.

Through a special arrangement with Power Technology Inc. (PTI) – a new entity of former GE Fitchburg engineers, marketing, design and factory supervisory experts – Dresser-Rand has augmented its resources to provide a concentrated focus on the development and manufacture of naval main propulsion turbines.

"Several years ago GE approached us about acquiring their Navy business," Hoffmann explained. "We justify the purchase based on parts and service alone. The aftermarket is a significant business on its own."

Dresser-Rand has been supplying ship components for Navy vessels for many years. "For quite a number of years we've supplied auxiliary pump drives and other equipment," Hoffmann said. "Some of the requirements are the same, but we didn't have any engineering support for the Navy propulsion steam turbine business segment. I specifically mean the nuclear Navy – carriers, submarines."

While Dresser-Rand had lacked the development and engineering critical mass needed for main propulsion steam turbine development for the nuclear fleet, General Electric had a wealth of expertise in Fitchburg. "The missing piece of the puzzle was having the know-how," Hoffmann said. The GE experts who formed PTI contracted with Dresser-Rand to fill in the company's technology gap. "Now we have access to the required expertise," Hoffmann said.

The first carrier to employ the Dresser-Rand main propulsion equipment will be the CVN 77 whose keel is to be laid early in 2003.

While much of the U.S. Navy's fleet is moving toward gas turbines, the Navy's carriers and submarines are sticking with steam. "Carriers and submarines must remain nuclear-powered," Hoffmann explained. Heat from the on-board nuclear reactor creates the steam that drives

the turbines that drive the ship. "A carrier now is refueled only once in its life time, creating tremendous logistical sense."

The new carrier contract is a significant step forward in Dresser-Rand's business with the Navy. The equipment is more massive – eight giant turbines. "Every carrier has four high pressure and four low pressure turbines that drive through four reduction gears driving four propellers," Hoffmann explained.

Last March, a contingent of Dresser-Rand executives and production specialists met with Newport News Shipbuilding at the Virginia shipyard to assure the shipbuilder of its commitment, method of operation and related matters.


"We have worked with Dresser-Rand for years on various ship components and we anticipate continuing this positive working relationship as they supply the steam turbines for the CVN 77," said Danny Switzer, Newport News Shipbuilding's construction manager for the upcoming carrier.

In July of 1998, Newport News Shipbuilding's new CVN 75 was commissioned the U.S.S. Harry S. Truman. The CVN 76, which will become the Ronald Reagan, is scheduled for christening in 2000. Dresser-Rand has supplied auxiliary steam turbines for both the CVN 75 and 76. The CVN 77 will have its keel laid in early 2003 with christening scheduled for late 2005 and delivery in late 2007 or early 2008. No name has been selected for the CVN 77.

Newport News Shipbuilding is the largest privately owned shipyard in the United States, having built nearly 800 military and civilian ships in its 112-year history. It is best known for its giant Nimitz-class aircraft carriers, sleek Virginia-class guided missile cruisers and the Los Angeles-class attack submarines.

"We are participating in some long range naval development programs for the next generation of carrier called the CVX," Hoffmann said. "It's just in the initial planning stage at this point, but Dresser-Rand is teamed with Newport News Shipbuilding and Electric Boat on the project. Our participation in this long term program will present opportunities for continued business for many years to come."

Dresser-Rand faces competition in the Navy business. Competing for Navy steam turbine business is the former Westinghouse plant in Sunnyvale, Calif., which is



now owned by Northrup Grumman. “The advantage that we have over them is that we have a large and healthy commercial business,” Hoffmann noted.

In addition to Dresser-Rand’s steam turbine business with the Navy, the Reciprocating Products unit in Painted Post, New York, has been supplying the Navy since before World War II, according to Robert Shepard,

Product Specialist for the company. “Painted Post has about 75 percent of the Navy’s shipboard compressors – high, medium and low pressure.” On the Truman carrier, “we have nine compressors, both reciprocating and centrifugal.” (Although the bulk of the domestic centrifugal compressors are produced at Dresser-Rand Turbo Products in Olean, New York, the

Painted Post operation produces centrifugal compressors for Navy use.)

The Navy contracts represent about 5 to 10 percent in business annually to Painted Post, Shepard said. That also includes the aftermarket, some of which includes decommissioned Navy ships sold or leased to foreign countries.

In this business sector, Reciprocating Products faces another type of competition – foreign. There is one domestic competitor, but the military is looking to pricing challenges and has opened the doors to bidding from countries beyond the U.S. borders, Shepard said. It may result in a slight decline in market share, he observed.

On the other hand, though, Dresser-Rand is expecting the overall growth in Navy business to be a significant addition to the bottom line for at least the next 20 years, with involvement in some of the most important naval projects, and continued increasing sales. ■

# First Chemical Texas Finds New Aniline Plant Start-Up A Painless Process

BAYTOWN, Texas—With more than 30 years of reliability at its Pascagoula, Mississippi plant, where a significant percentage of the world's aniline is produced, First Chemical Texas wanted to replicate that success at its new Baytown, Texas facility to keep up with increasing world demand. Officials turned to Dresser-Rand for the same equipment, but with some engineering advancements.

"The client came to us, and indicated they wanted to put the identical compressors into the Baytown plant," said Lou Mercurio, Sr. Technical Specialist of Dresser-Rand Reciprocating Products. "At the same time, they wanted to upgrade the operation to achieve slightly higher discharge pressures."

The Pascagoula facility operates five "L" AXI 155L38 compressors all feeding a common head. At the new facility, a volumetric flow of 53,000 CFM was required. The "L" AXI compressor is a spherical screw, positive displacement compressor, originally manufactured by Ingersoll-Rand, and now made by Dresser-Rand's service facility in Chesapeake, Virginia.

"The decision to go back to Dresser-Rand was based on the reliability of the existing

units at the Mississippi plant," said C. Aubrey Johnson, Maintenance Supervisor for First Chemical Texas. "We normally run four of the five with one on stand-by at all times, so reliability is critical."

First Chemical Texas L.P., a ChemFirst Incorporated company, is one of the world's leading suppliers of aniline, a chemical used in rubber processing, dyes and pigments, and pharmaceuticals such as acetaminophen, a common pain reliever. Industry reports indicate demand for aniline in 1998 at approximately 1.6 billion pounds, and this figure is expected to grow by more than 12 percent to 1.8 billion pounds by the year 2000. Aniline is produced by the hydrogenation of nitrobenzene, and uses nitric acid as the feed stock.

In 1996, First Chemical Texas and Bayer reached an agreement on a joint project involving the construction of a new aniline production operation in Baytown, located about 30 miles east of Houston. The new facility would be modeled after the Mississippi plant, but would increase First Chemical's production capacity by 250 million pounds per year for Bayer's methylene diphenyl diisocyanate (MDI) operation, also recently completed in Baytown.



Dresser-Rand was able to provide the new "L" AXI compressors with design improvements over the previous units. "Because this is a low mole weight and high flow application, a 'screw machine' is the best solution," said Mercurio. "But we were able to make improvements to the case design as well as subtle improvements to the related equipment."

The manufacturer switched to cast steel casings for the compressors to accommodate First Chemical's higher pressure requirements, as well as upgrades to the lube oil system for improved reliability and ease of maintenance. "The lube oil system

is integral to the compressor, and each of the five units has a separate seal oil system," Mercurio added.

Dresser-Rand also provided the motor, baseplate package, seal oil console, silencers and instrumentation for the compression trains.

The Baytown plant began production in March of 1998. "The facility started up ahead of schedule and is producing at above design capacity," said Johnson.

With the added capacity of the First Chemical Texas Baytown facility, the company has doubled its annual aniline output. ■

# profile:

## Philippe Auber

### Philippe Auber: Experience Contributes To Success Of Dry Gas Seal Project

One of the team members, Philippe Auber, manager of gas seals R&D for Dresser-Rand Turbo Products in



*Philippe Auber  
Dresser-Rand  
Senior Product Engineer  
LeHavre, France*

In 1994, when Dresser-Rand decided to design a new line of dry gas seals that would match Dresser-Rand centrifugal compressors, they looked to a team of engineers, draftsmen and production personnel from the Olean, New York and LeHavre, France facilities. Knowing that gas seals represent a large percentage of the cost of the bare compressor, the goal was to control overall costs by incorporating less expensive gas seals. Those gas seals could be integrated with the design of the compressor, and offer superior reliability and innovative performance features.

The team consisted of a group of individuals who collectively brought a wealth of experience and a unique set of skills and assets to the project.

LeHavre, has been helping the company improve technology since he began his career with Dresser-Rand in 1981 as a project engineer. His experience on other seal development projects was one of the reasons for the success of the dry gas seal project.

In the early 1990s, Philippe was part of a team that produced a new design on contact seals for two gas turbine driven boosters. The project called for a pressure level of approximately 1000 psi. The existing low-pressure contact seal design, which would accommodate approximately 125 psi, required replacement.

"To correct the problem," Patrice Bardon, Engineering Manager recalled, "Philippe had to convince our management team and the customer that we were able to design and build a new type of

contact seal that would work effectively for a duty as severe as this, even though it was an "unknown territory."

Philippe designed a new contact seal and defined the system that went along with it.

"We spent a lot of time explaining to the customer the functions of each feature of the new seal," Philippe said. "We then manufactured, tested, and installed the seals in the machines. With each problem that we encountered, we knew how to solve it, which told us we were on the right track." This experience paid off when it came time to develop the new dry gas seals.

"We learned a lot from that project, and this experience assisted us in the gas seals project as we applied some of the features of the high pressure contact seals to the dry gas seals. Philippe's role

The design innovations incorporated into the Dresser-Rand Dry Gas Seal include a patented groove on the rotating seal face to maximize seal operation at various operating conditions, and a proprietary pusher ring design to minimize the risk of "hang-up." The seal design also allows for the minimum cartridge length, providing the minimum bearing span for the machine.

More than 90 of the new seals have been produced to date, used on equipment operating at up to 1,300 psi, and exceeding all expectations.

Minimizing product complexity shows itself in Philippe's work, but he also has a way of reducing complexity in his personal life. From the LeHavre plant, Philippe is only a 30 minute walk from where his boat is

**"Philippe's role in the dry gas seal project was to make the design, and then to make the design work," Michel Rabuteau, Gas Seal SBU Manager.**

in the dry gas seal project was to make the design, and then to make the design work," Michel Rabuteau, Gas Seal SBU Manager said. "This was largely done by constantly thinking of new ideas, discussing them with others, and by conducting extensive research on the gas seals. As a team, we knew we had to keep the design simple."

docked. Philippe sails often on his 32-foot sailboat, Tusen Takk, which means a thousand thanks in Norwegian.

Philippe resides in LeHavre with his wife and their three sons. ■

# engineer's notebook

## Investigation of the Circumferential Static Pressure Non-Uniformity Caused by a Centrifugal Compressor Discharge Volute

James M. Sorokes  
Cyril J. Borer  
Jay M. Koch  
Dresser-Rand  
Turbo Products  
Olean, N.Y., USA

The following is the second installment of a two-part article that was first presented at the American Society of Mechanical Engineers (ASME) Turbo Expo in Stockholm, Sweden, June 1998.

### MEASURED DATA

#### Static Pressure Taps

As noted, static taps were installed at three key locations in the third stage: i.e., the impeller inlet, the impeller exit, and the diffuser exit near the entrance to the volute. Pressure distributions were recorded at several operating conditions across the performance map. However, for conservation of space, only distributions for near minimum stable flow, near design flow, and at maximum flow rates are presented.

The impeller exit and diffuser exit static pressure distributions taken near minimum stable flow (i.e., just prior to onset of rotating stall) are shown in Figure 12. The distributions measured near design flow are given in Figure 13 while those acquired at maximum flow are illustrated in Figure 14.

Clearly, the distributions are not uniform circumferentially and mimic the trends observed by Hagelstein et al.. Unlike the results of the earlier researchers, there is a substantial difference between the magnitude of the pressure dip at the diffuser and impeller exits. In general, the variation in static pressure at the diffuser exit is approximately twice that at the impeller exit. This trend seems to hold for all three flow conditions.

By comparing the three distributions (Figures 12, 13, and 14), one immediately notes the movement of the minimum static pressure relative to the volute tongue. At minimum stable flow, the minima occurs near the 185 degree position. At design flow, the minima has moved near 300 degrees and at maximum flow, the minima is near 310 degrees. It is also clear that the magnitude of the non-uniformity is highest at the maximum flow rate.

Of even more importance, the impeller inlet pressure distribution showed evidence of the non-uniformity. The static pressure distribution shown in Figure 15 represents the most complete impeller inlet distribution that was acquired prior to the failure of the tubing (noted previously). These taps

at the inlet guidevane upstream of the third stage impeller clearly showed a pressure variation around the circumference of the machine. In short, the non-uniform static pressure field is enveloping the impeller. [This should not be too surprising. The compressor inlet conditions will adjust in reaction to the change in downstream pressure. Similarly, the individual flow passages within the impeller will react to a non-uniform downstream pressure. The variation in the individual passages then influences the inlet pressure field upstream of the impeller.]

### Dynamic Pressure Probes

The peak amplitude in the pulsations recorded by the dynamic pressure transducers located within the third stage occurred at 15 times running speed (Figure 16). It should come as no surprise that the third stage impeller has 15 blades and that the highest amplitudes were registered at or near the impeller exit. In short, the dynamic pressure probes were sensing the 15 blade wakes.

Reviewing the magnitude of the pressure pulsations, the peak response occurred while the

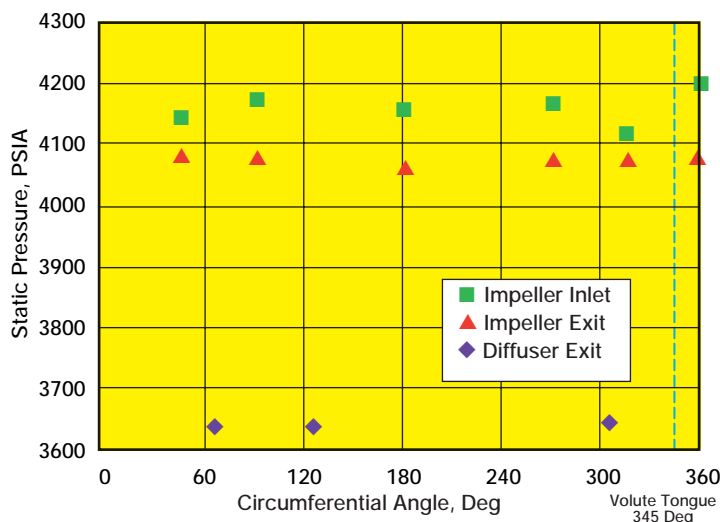


Figure 12. Circumferential static pressure distribution for stage 3 of 6 in test rig, near surge flow.

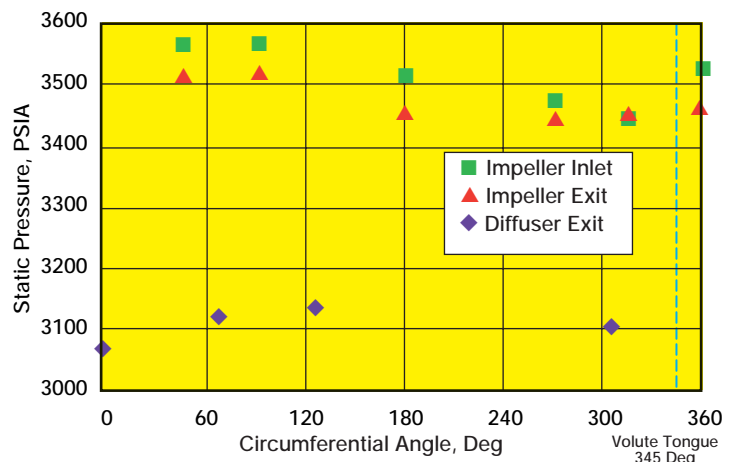


Figure 13. Circumferential static pressure distribution for stage 3 of 6 in test rig.

compressor was running in overload. This is not unexpected as the impeller exit absolute velocities would be highest during overload operation, causing the maximum differential between the static pressures in the core and wake regions.

Of interest, the dynamic pressure transducers showed little or no activity near 1X. That is, there was no indication that a one lobe pressure non-uniformity was rotating circumferentially around the compressor. Therefore, it was concluded that the static pressure non-uniformity detected by the static taps was stationary for any given flow condition.

### Strain Gages

The strain gages installed on the third stage impeller yielded some interesting trends. The peak response occurred at one times the compressor running speed with little or no noticeable peaks at other frequencies (Figure 17). Like the response in the dynamic pressure transducers and static taps, the amplitude of this 1X excitation was highest when the compressor was running at the overload end of its performance map (Figure 18). A 1X response might be

confusing until one recalls that the strain gages are in the rotating frame of reference. Each strain gage will pass through the pressure non-uniformity detected by the static taps once per revolution as the impeller rotates. Since the circumferential static pressure variations both upstream and downstream of the impeller are highest when the compressor is operating in overload, it should follow that the forces acting on the impeller would be maximized at this operating condition.

It was also noteworthy that the circumferential location of the peak dynamic stress detected by the strain gages appeared to move as the flow rate was adjusted from surge to overload. By comparing the phase relationship of the three probes located on the impeller, it was possible to resolve the circumferential location of the maximum response. The rough locations of the peak dynamic strain for the near stall and overload conditions are sketched in Figure 19. These results support the existence of the pressure non-uniformities predicted by the CFD results and measured by the static pressure taps.

### Problem Resolution/Status

The testing described in this paper failed to identify the root cause of the impeller failures, but it did provide valuable insight into the forces acting on centrifugal impellers in high pressure applications. A tremendous amount of knowledge was gleaned from this test program regarding the aero-mechanical forces acting upon the impellers in a high pressure, gas re-injection compressor operating at near field conditions. In addition, valuable lessons were learned regarding the use of atypical instrumentation and its associated hardware.

Due to this testing, resonance was eliminated as a possible cause. However, testing/analysis did show that overload operation is a prime suspect for the failure because the highest strains were measured in the high flow region of the performance map. Further tests will be conducted that should ultimately lead to the true source of the problems. The information derived from these test programs will be used to develop more reliable and accurate analytical methods in efforts to preclude recurrence of these problems in future machines operating under similar conditions.

### Further Considerations

Since it has been established via CFD and test measurements that the pressure is non-uniform at both the impeller inlet and exit, it follows that as the impeller rotates, the individual blades will be subjected to this non-uniform field. In particular, the leading edge of each blade must pass through the non-uniform field once per revolution. The result will be fluctuations in the inlet velocities, Mach numbers, flow angles, pressure profiles, etc. within the various passages. The impeller CFD analyses suggest that a large leading edge pressure differential resulting from high negative incidence caused by overload operation. The high negative incidence also causes flow separation from the pressure surface, resulting in a very disturbed flowfield within each impeller passage [see Figures 5 and 6].

Since each impeller blade passes through the non-uniform field at different times during one revolution, the flow conditions in adjacent passages will vary. In fact, it is highly likely that the conditions within any given blade passage will "fluctuate" due to the non-

Continued on page 16

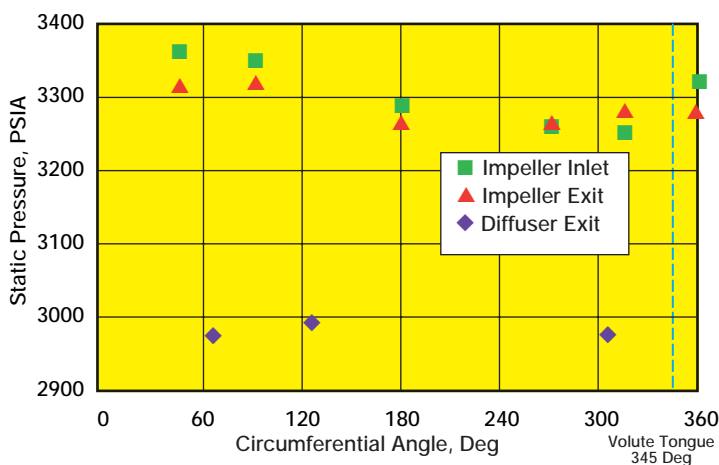


Figure 14. Circumferential static pressure distribution for stage 3 of 6 in test rig.

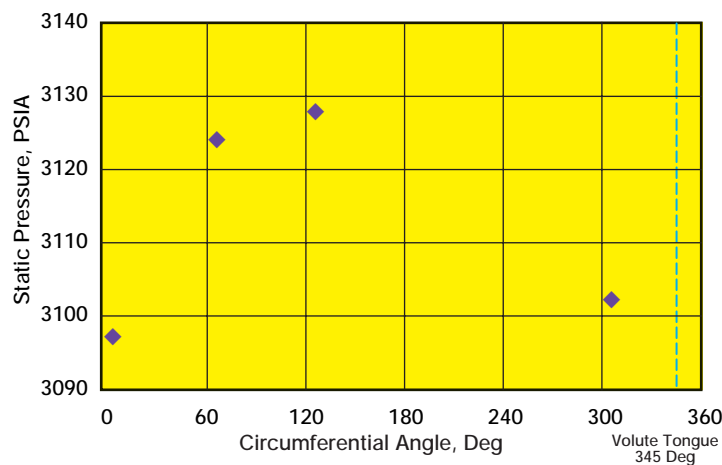


Figure 15. Impeller inlet circumferential static pressure distribution for stage 3 of 6 in test rig.

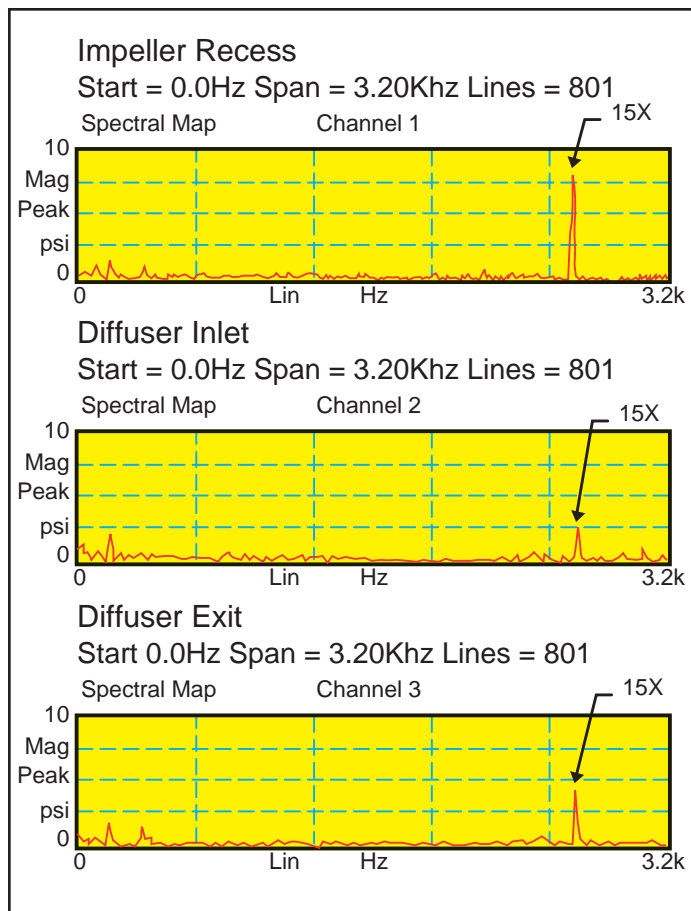


Figure 16. Dynamic pressure response for stage 3 of 6 in test rig.

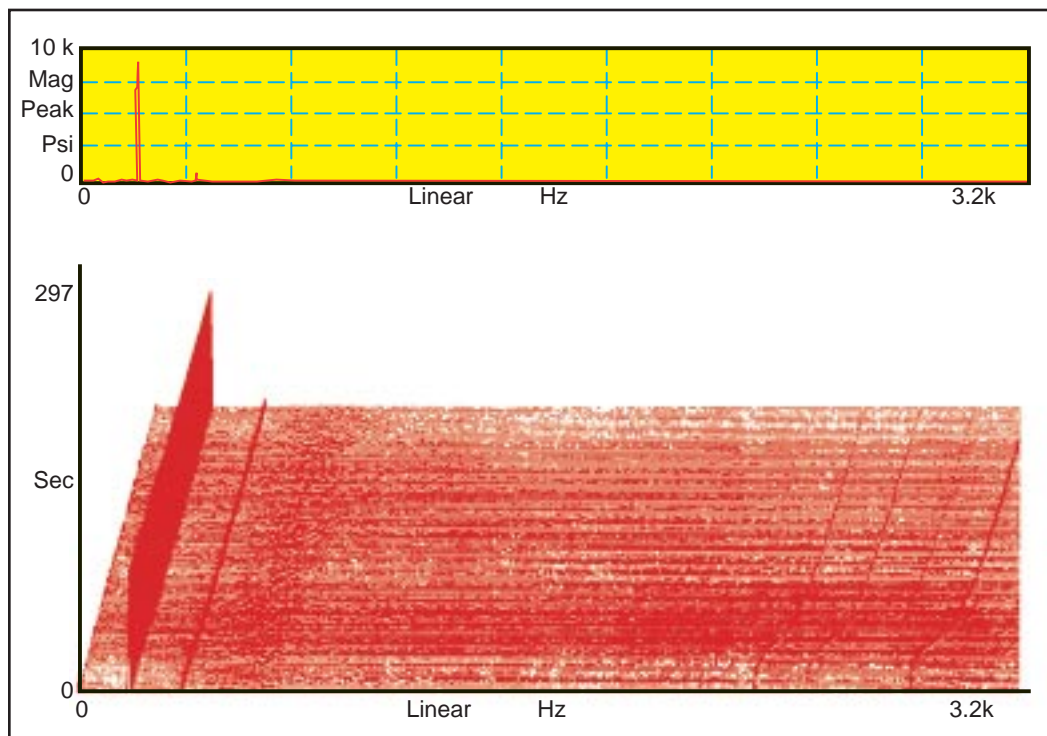


Figure 17. Strain gage measurements for stage 3 of 6 in test rig.

## Investigation of the Circumferential Static Pressure Non-Uniformity...cont'd

Continued from page 15

uniform inlet and exit conditions as the impeller rotates through the skewed pressure field. The non-uniformity in the passage-to-passage distributions will also undoubtedly cause fluctuations in the impeller exit flow profile.

Coupling the observations made in the impeller CFD studies with the fluctuating conditions which likely result in the impeller due to inlet and exit pressure fields caused by the volute, it is not difficult to hypothesize a fairly high dynamic pressure load within the impeller. This dynamic load, if sufficiently severe, could be a major source of the excessive aero-mechanical excitations which caused the impellers to fail. These

unsteady flowfields within and around the impeller could also lead to either: a) premature impeller stall or b) a stall in the vaneless space immediately outside the impeller.

### Further Analytical Work

There are tremendous complexities involved in trying to understand the aero-mechanical influences of this phenomenon using CFD. The analytical techniques must be capable of accounting for the non-uniform circumferential pressure field and its influence on the impeller inlet conditions. Several CFD codes now have the capability of simultaneously solving the impeller, vaneless diffuser and volute for a steady state solution. The main drawback for this type of problem is grid size and the corresponding solution time. To complete this solution, a full 360 degree impeller must be modeled. This necessitates a limit on the impeller nodes to reach a workable problem size of 500,000 to 1 million nodes. Plans are currently in place to complete this steady state analysis.

The previous discussion assumes a steady state solution. But an impeller rotating within a non-uniform pressure distribution will result in transients within the impeller flowfield and an unsteady nature to the impeller's inlet and exit conditions. Since the impeller and diffuser do not operate independently, the fluctuating impeller exit conditions further contributes to the already chaotic nature of the diffuser pressure field. This, in turn, has a "back-influence" on the impeller and creates interaction between the components. Clearly, the transient is an extremely complex problem that is likely beyond the capabilities of most industrial companies and most of today's CFD solvers. It is

only with continued research testing, supplemented by steady state CFD analysis, that we will gain further insight into the exact nature of the volute's influence on upstream stage elements.

### Further Planned Tests

Plans are underway to perform additional testing using the full load, full pressure test vehicle to investigate methods for eliminating or at least reducing the magnitude of the non-uniform pressure field. In the next phase of tests, the vaneless diffuser following the third impeller will be replaced with a low solidity vaned diffuser (LSD); i.e., similar to the investigation conducted by Hagelstein et al. (1997). The full compliment of instrumentation from the original tests will be left in the compressor and additional probes will be added to help further resolve the pressure and strain distributions. Additional steps will be taken to extend the life of the static pressure instrumentation to insure that valid results are obtained over the duration of the testing.

Beyond the vaned diffuser testing, some consideration is being given to alternate volute concepts including: alternate area distributions, alternate diffuser styles, "pseudo" or false tongues, etc.

### CONCLUSIONS

The results described in this paper represent a portion of data acquired during full load, full pressure testing of a re-injection compressor in an attempt to ascertain the forces contributing to repeated impeller failures. During the testing, sufficient data (static pressures, strain) was obtained to firmly establish the existence of a non-uniform pressure field that enveloped the third stage; which contained an impeller, vaneless diffuser, and discharge

volute. The findings of this study are very similar to those obtained by Hagelstein et al. (1997); although their work was conducted using a single stage test vehicle operating at atmospheric inlet pressure.

CFD studies had suggested that a volute would cause a non-uniform pressure distribution in the upstream vaneless diffuser and the test data validated the CFD results. The test data also confirmed that the pressure non-uniformity extends upstream of the impeller; implying that the impeller is subjected to varying inlet and exit conditions. Obviously, if both inlet and exit boundary conditions vary, the passages within the rotating impeller must be highly complex and unsteady. Given the high discharge pressures involved in typical re-injection compressors, it is easy to hypothesize forces sufficiently extreme to contribute to premature stall, rotordynamic difficulties, or even an impeller failure.

The convoluted flowfield involved in the impeller/diffuser/volute arrangement is likely beyond the capabilities of today's CFD solvers. Therefore, research testing remains the most effective means for deriving the information necessary to fully understand the interactions of these flow components.

For a copy of the complete article, contact Dresser-Rand Marketing Communications at Dresser-Rand Turbo Products, Paul Clark Drive, P.O. Box 560, Olean, New York 14760, (716) 375-3990, or visit the *insights* magazine web site at [www.dresser-rand.com](http://www.dresser-rand.com). ■

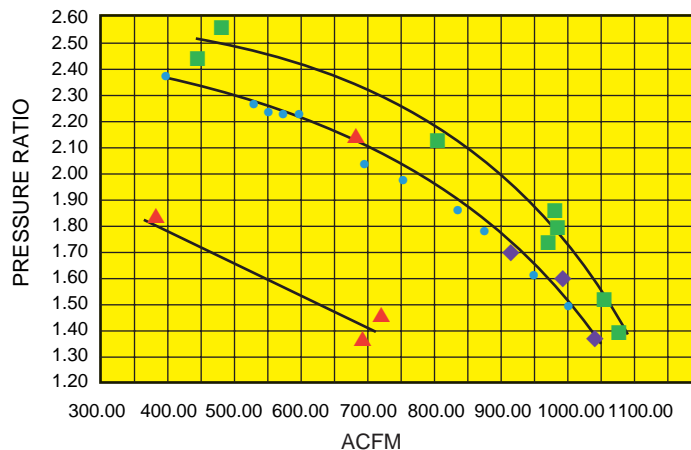


Figure 18. Dynamic Stresses (mean to peak) at impeller leading edge, stage 3 of 6.

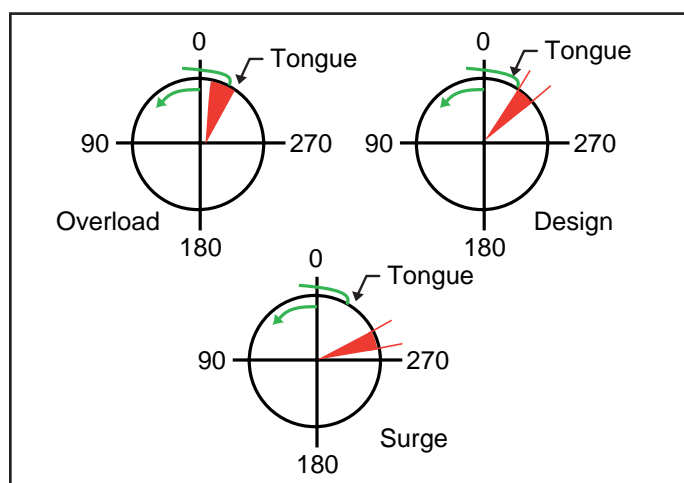


Figure 19. Circumferential location of peak dynamic strain.

## Engineer's Extra

As a regular feature of *insights* magazine, an additional technical article will be added to the Dresser-Rand world wide web site at [www.dresser-rand.com](http://www.dresser-rand.com). Visit the Dresser-Rand web page for past issues of *insights* magazine, as well as the new Engineer's Extra section.

This quarter, the Engineer's Extra article is:

**Modernizing a Proven Reciprocating Compressor Line,**  
by Martin Hinchliff, manager of product analysis engineering at the Dresser-Rand Reciprocating Products operation.



## Dresser-Rand Engineers Receive U.S. Patents For Inventions

WELLSVILLE, New York – Dresser-Rand Company has announced that several engineers from its Energy Systems facility in Wellsville, New York, have been granted U.S. patents for their inventions. All of the designs further the reliability, efficiency, or ease of maintenance of steam turbine and related turbomachinery manufactured by Dresser-Rand.

Dresser-Rand Energy Systems engineers, Stephen Edney, Nyhal Austin and George (Ed) Hedrick were granted a patent for their invention of a Tilting Bearing Pad with an Axial Feed Groove having an Exit Side Profiled Area for use in a steam turbine engine.

William Maier, Sr. Engineer, Process Enhancement Group for Dresser-Rand Energy Systems also received a U.S. patent for his invention of a Turbine Diaphragm Assembly. This patent deals with improving the cost and performance of steam turbine diaphragms through a new nozzle design, which accelerates and directs the steam at the turbine wheels to produce power. Randall Moll, Sr. Engineer, Process Enhancement Group for Dresser-Rand Energy Systems was also granted a U.S. patent for his improvements in the design of a Journal Bearing Assembly.

A fourth patent was granted to Fred Canova, formerly the vice president of engineering for Dresser-Rand Energy Systems before his retirement in 1993. Canova was granted a patent for his Diaphragm Construction for Turbomachinery, which is a highly accurate, reproducible and economical method of manufacturing split diaphragms for use in turbomachinery when the diaphragm is first machined axially. ■

## Dresser-Rand And Alfred State College Joint Venture Establishes CNC Machine Tool Technology Laboratory

WELLSVILLE, New York – With skilled machinists in short supply throughout the United States, the Dresser-Rand Company has joined the State University of New York College of Technology at Alfred to offer a hands-on machine tool technology course at the company's Energy Systems facility in Wellsville, New York. The Computer Numerical Control (CNC) Technology Laboratory was made possible through an Appalachian Regional Commission grant, the Southern Tier West Regional Planning and Development Board, and the donation of laboratory and classroom space at Dresser-Rand's Energy Systems facility in Wellsville, New York. Dresser-Rand also donated the use of equipment, which includes a CNC/Manual Bridgeport Mill with tooling.

In celebration of the machine tool technology laboratory, a ribbon cutting ceremony recently was held at Dresser-Rand's Energy Systems facility. The event began with a tour of the plant, followed by a ribbon cutting ceremony in front of the CNC Machine Tool Technology Laboratory. Dresser-Rand Energy Systems president Dennis Weimer led the tour which included

several dignitaries such as: U.S. Representative Amo Houghton, R-NY, 31st District; William Rezak, President of Alfred State College; and Craig Clark, Dean of Alfred State College's Vocational Technology Campus.

The program was designed to expand the number of available, well-trained machinists. The modular structure of the courses has students in the classroom for lecture or laboratory six hours per day, five days a week.

As a one-year program, the course includes both an entry-level machine tool certificate and an advanced machine tool certificate. The one-year machine tool certificate program instructs students on the safe operation of all basic machine tools, such as lathes, milling machines, drill presses, various saws, and grinding equipment. Proper measurement and inspection of parts, in addition to shop math, the interpretation of engineering drawings and mathematical calculations are also part of the program.

The advanced machine tool certificate program includes CNC programming, with an emphasis on CNC operating lathes and milling machines and Electronic Discharge Machines. This course also includes the set-up as well as the operation of the machines and will also have an

emphasis on the interpretation of engineering drawings and control documents.

After successfully completing the one-year program, students will be able to enter the industry as an entry-level machinist or continue on in the two-year degree program. The two-year degree program, which is equivalent to an associate's degree in occupational studies (AOS), includes material from both the entry-level and advanced machine tool certificate programs.

An AOS degree in machine tool technology, will allow students to enter the work force as tool and die makers, machinists, machine setters and operators, mold makers, and CNC machinists.

The incentive behind the machine tool technology programs was based upon industry needs. The Machine Tool Advanced Skills Technology Program is supported by the Office of Vocational and Adult Education of the U.S. Department of Education.

"The CNC Machine Tool Technology course being offered by Alfred State College is an excellent program because it is an investment in the future of manufacturing and technical skill," said Weimer. "Having well-trained machinists is vital to a company like Dresser-Rand." ■



*Dresser-Rand's new electron beam weld machine can accommodate the largest impeller in the DATUM line of centrifugal compressors.*

### **Dresser-Rand Olean Installs New Electron Beam Welder; A Key Tool For Manufacturing DATUM EBraze Welded Impellers**

OLEAN, NY - Dresser-Rand has announced that installation is now complete on its new vacuum chamber electron beam (EB) welder that has the capacity to weld an impeller with an overall diameter of more than five feet and a weight of three tons. This tool, which is installed at the Turbo operations head-

quarters in Olean, NY, will be used primarily for the production of EBraze welded impellers. EBraze is a newly developed technology offered by the company in its DATUM centrifugal compressor product line.

The new electron beam welder, which is a five axis tool, took three months to install and has substantial capacity and capabilities.

"The investment this new EB welder is further proof of our commitment to offering a superior centrifugal compressor (DATUM) to our customers," stated Vince Volpe, president of the Dresser-Rand Turbo operations in Olean. "This new tool provides Dresser-Rand with unique capabilities in the manufacture of impellers." ■

## Global Visions...

Continued from page 19

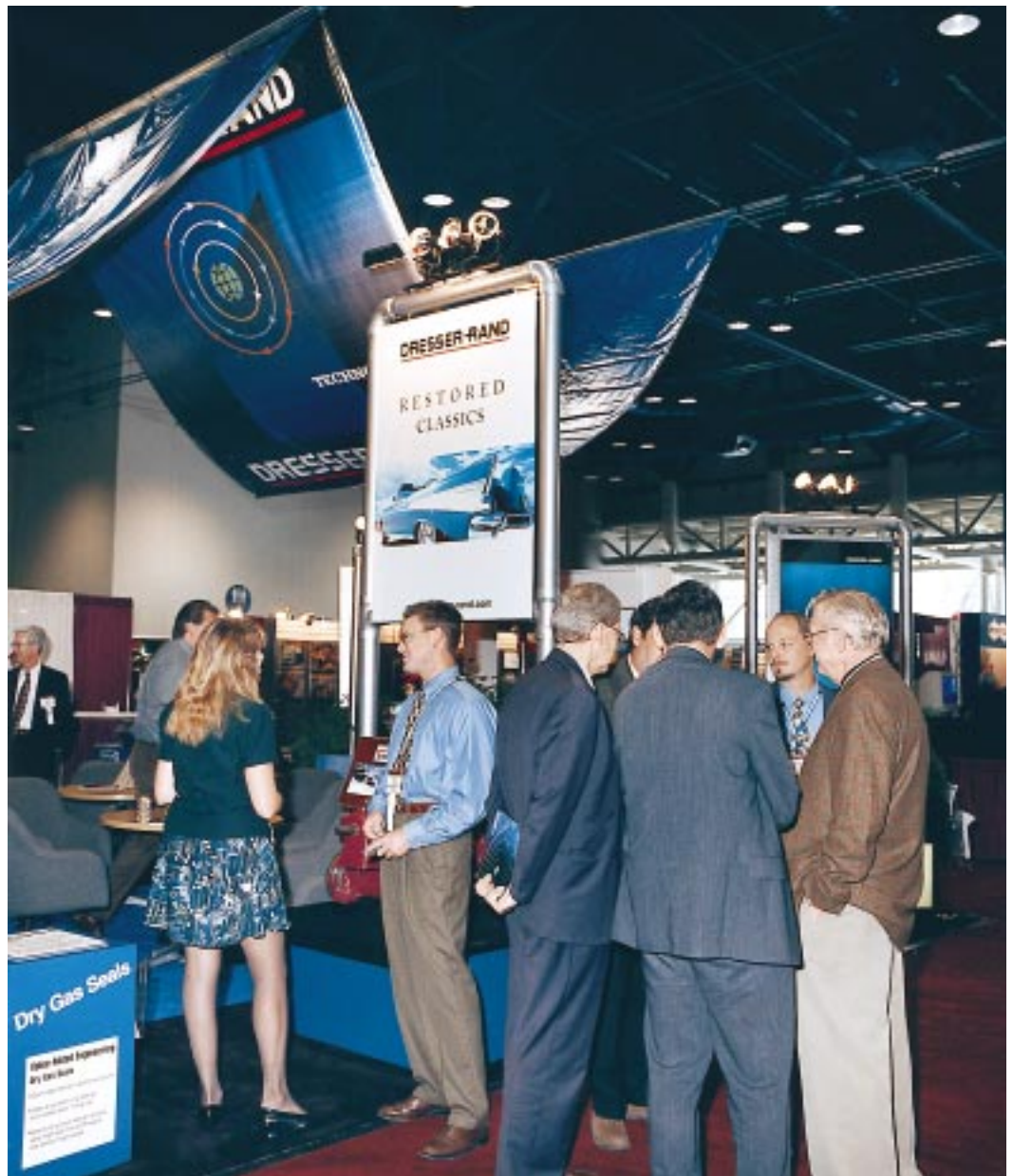
### Dresser-Rand Awarded Ultramar-Diamond Shamrock Refinery Equipment Contract

Dresser-Rand has been awarded a contract to supply fluid catalytic cracking (FCC) equipment to Ultramar-Diamond Shamrock, with headquarters in San Antonio, Texas. The equipment will be installed at Ultramar-Diamond Shamrock's McKee refinery near Sunray, Texas.

Dresser-Rand will provide the McKee facility with an axial compressor, expander, gear and motor generator. The units will be replacing an existing expander train which was installed in 1979. A 45 to 50 percent increase in flow is expected with the installation of the new units.

With over 30 years experience, Dresser-Rand is the international leader in the FCC expander market, supplying approximately 65 percent of the equipment in use today. Dresser-Rand supplied its first expander in 1963, and has shipped over 60 units since then.

The compression equipment will be manufactured at Dresser-Rand's Turbo Products facility in Olean, New York, and is expected to be shipped in 4th quarter 1999. The motor generator will be manufactured at Dresser-Rand Electric Machinery in Minneapolis. ■



More than 2,500 visitors attended the recent 27th annual Turbomachinery Symposium in Houston.

### Dresser-Rand Greets Clients At Turbomachinery Symposium

HOUSTON—Dresser-Rand was a key exhibitor at the recent 27th annual Turbomachinery Symposium in Houston, sponsored by the Texas A&M Turbomachinery Laboratory. The conference hosted 219 exhibiting companies and was attended by more than 2,500 from around the world.

Of primary interest at the D-R booth were: the new syn-gas steam turbine from Dresser-Rand Energy Systems; the introduction of the vertical rotor storage program by Dresser-Rand Services; news on the sale of the 100th DATUM centrifugal compressor from Dresser-Rand Turbo Products; and information from Dresser-Rand Control Systems highlighting a controls retrofit at a PEMEX pipeline installation.

Two engineers from Dresser-Rand Turbo Products presented a technical paper at the conference. Jim Sorokes, supervisor of aero-performance engineering, and Fred Marshall, manager of compressor engineering co-authored and presented "Aerodynamically Induced Forces Acting On Centrifugal Compressors And Resulting Vibration Characteristics Of Rotors." ■

## Ingersoll-Rand Named A Best Managed Company For Second Consecutive Year

Ingersoll-Rand, parent company of Dresser-Rand was selected for the second consecutive year as one of the top 100 best managed companies by Industry Week magazine.

In Industry Week's third annual report, the 100 companies selected for this honor demonstrated superior, consistent financial performance. The magazine also recognized the companies who are heavily investing in change, market development, people, and society.

Finalists for this years review consisted of the 100 companies that were selected as the best managed companies for 1997, of which Ingersoll-Rand was included, along with an additional 100 companies based on a proprietary financial formula created in partnership with Moody's Investors Services. Industry Week then looked at each individual company's performance in the following areas: profit margins, leverage, sales turnover, return on assets, and return of equity. Four years of data supplied by Dun & Bradstreet and Moody's was analyzed. In addition, 85 international expert panelists were quizzed on the final 200 companies selected.

"Managing the modern manufacturing firm is harder than managing a service company," said Industry Week editor John Brandt. "Not making the list doesn't necessarily mean a firm isn't well-managed; there are firms among the Industry Week 1000 whose financials might seem to place them ahead of some of our 100. But the 100 Awards emphasize management over the long-term and positioning for the future over short-term results. In our judgement, the 100 companies we've selected have done a better job than their peers."

Additional information on the top 100 managed companies can be found on the magazine's web site at [www.industryweek.com](http://www.industryweek.com). ■

## Dresser-Rand Awarded Coastal Corporation Contract

OLEAN, New York—Dresser-Rand has been awarded a contract to supply ABB Lummus with compression equipment for a Coastal project. The equipment will be used at Coastal's delayed coker project located at San Nicolas, Aruba.

Dresser-Rand will be supplying a single stage condensing steam turbine driving a two section, intercooled centrifugal compressor. The compressor is an exact duplicate of an existing compressor train that was sold for a similar Coastal project in 1994.

The equipment is expected to be shipped in June of 1999, and the installation date is scheduled for late 1999. ■



## "insights" Now On The World Wide Web

*Insights* magazine, has been added to Dresser-Rand Company's world wide web site. The magazine can be accessed on the world wide web at: [www.dresser-rand.com](http://www.dresser-rand.com), and then by selecting D-R insights from the top menu bar.

*Insights*, a quarterly publication, provides the latest news and developments on Dresser-Rand, and is targeted towards D-R customers worldwide. The magazine recently replaced Turbovisions, the Olean facility's customer magazine.

In addition to *insights* being easily accessed on the world wide web, Ingersoll-Rand's customer magazine, *Compressed Air*, can also be viewed on the internet at: [www.ingersoll-rand.com](http://www.ingersoll-rand.com) and by selecting *Compressed Air* from the left menu bar.

*Insights* has been established as a portable document format (pdf) file, and can be accessed by using the Adobe Acrobat program. The Adobe Acrobat program can be easily installed if a system does not currently have it. Once the Adobe program is downloaded, a user will not have to repeat the process each time the web page is accessed. ■

# insights

*Editorial Statement:*

*"insights" is a periodical publication of the Dresser-Rand Company. Its editorial mission is to inform our readership in the areas of energy industries, as well as business, and world affairs that have an impact upon our mutual concerns. Comments, inquiries and suggestions should be directed to:*

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