Compressor Works

ACI Services, Inc.

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ACI Continues Increasing Product Portfolio Through Proven Design Methods

ACI has employed Finite Element Analysis (FEA) on many projects as part of our standard engineering practice. Recently our FEA technology has proven to be a beneficial tool in aiding in identifying the failure mode of an uncommon failure of a typically stout compressor component, the distance piece.

A North American Chemical company had experienced multiple distance piece failures of a fabricated distance piece design on a Worthington SuperCub compressor. Due to the inability to procure new cast distance pieces, the end user elected to procure a fabricated distance piece that allowed the end user to meet requirements for H2S service. Unfortunately the fabricated design as shown in Figure 1 did not properly take into account all of the stresses that are transmitted through the distance piece and deflection experienced due to rod and bolt loading.

Fig. 1—Fabricated Distance Piece

After a short period of operation at normal plant load conditions, the distance piece failed breaking into multiple pieces as shown in Figure 2.

Fig. 2—Fabricated Distance

ACI was commissioned to conduct an FEA of the existing design in addition to developing a new design in line with standard proven compressor design practices.

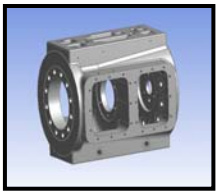


Fig. 3—Cast Distance Piece

Upon completion of the FEA on the existing fabricated distance piece, it was determined that there was a large amount of deflection (greater than 0.016 in) in the cylinder body to distance piece joint as well as a lower than acceptable cyclic fatigue factor (CFF) in the high stress areas (CFF of 0.8 which is lower than the industry accepted 1.8 for infinite life).

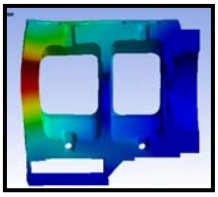


Fig. 4—Meshing depicting component deflection

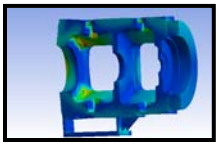


Fig. 5—Meshing depicting component stresses

The goal for ACI was to design a distance piece minimizing the deflection in addition to increasing the CFF. The new distance piece is designed as a cast component manufactured from nodular iron. The design incorporates the appropriate ribbing to increase the strength accordingly as shown in Figure 3.

ACI developed an FEA model of the new designed distance piece and subjected the component to the same loading as previously used for the fabricated distance piece. The resulting deflection was decreased to less than 0.002 in and the CFF was increased to 6.1 in the same corresponding areas as the fabricated design.

Please contact Chad Brahler at 740-435-0240 ext. 501 or cbrahler@aciservicesinc.com for more information.

Inside this issue:

Look for ACI at these Events in 2010:

Mar 7-9, Gas Compressor Association Expo; Galveston, TX

Mar 15-17, Gulf South Machinery Symposium; Baton Rouge, LA

May 11-13, Eastern Gas Compression Roundtable; Coraopolis, PA

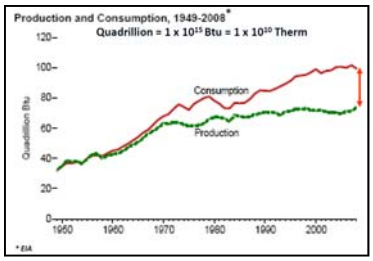
Jun 8-10, Global Petroleum Show, Calgary AB

Sept 27-30, Gas Compressor Conference; Norman, OK

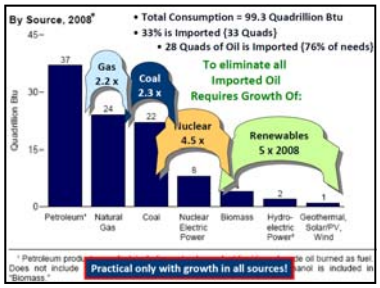
Sept 20-23, Turbomachinery Symposium; Houston, TX

Oct 4-6, Gas Machinery Conference; Phoenix, AZ

ACI Presents at the 2009 ASME Energy Sustainability Conference



USA Energy Production falls short of meeting the Annual USA Energy Consumption by about 30 quadrillion BTU.



Natural Gas is part of a solution, all energy sources need to grow to replace imported oil.

This 3rd International Conference on Energy Sustainability (ES2009) was an orchestrated effort by the American Society of Mechanical Engineers (ASME) to provide a technical forum for in-depth discussions of the sustainability of energy sources. Even in the current global economic downturn, business in sustainable energy technologies continue to thrive and offer a path forward into a future of plentiful, affordable energy. Interest in sustainable energy has remained robust due to mounting problems related to fossil fuels; global competition for limited resources; environmental consequences associated with extraction; and the effects of global warming. Energy Sustainability 2009 addressed these issues by disseminating information with technical depth and breadth and by providing a venue for professionals to share information and engage in expert debate on topics of importance critical to furthering sustainable energy technology and policy.

ACI's Norm Shade was featured as a keynote speaker discussing *Efficient Use of Our Natural Gas Resources—An Important Component of Energy Sustainability*.

Shade stressed any effective strategy for energy sustainability must include a significant near term contribution from natural gas. Environmentally friendly compared to other hydrocarbon fuels, recent technological breakthroughs have unlocked as much as 120 years of domestic supply. Unlike renewable energy sources, which require major infrastructure investments, government subsidies and development time, an extensive natural gas pipeline network already exists to deliver and transport this resource to market. With a supply surplus available now, aggressive expansion in the use of natural gas for vehicle fuel is a practical way to significantly reduce the USA's dependence on imported oil, while also reducing air pollution. Natural gas can bridge a significant gap while technologies are developed and commercialized for increased efficiency and "greener" alternatives to traditional hydrocarbon energy sources.

To view the entire presentation, please visit our website at www.ACIServicesInc.com.

Another OEM Develops its Compressor Performance Program Around ACI's eCurves® Technology

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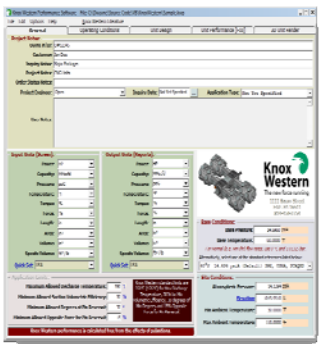

Project input screen

Throughout 2009, ACI developed Knox Western's OEM Performance Software, KWPerformance™. This soon-to-be-released software package provides Knox Western engineers, packagers, and end-users with advanced tools for sizing reciprocating compressors, and for quickly checking unit performance (flows, loading, and safety).

Knox Western designs and manufactures a wide line of high-speed reciprocating compressors for the Natural Gas markets, including CNG. KWPerformance™ currently supports a variety of measuring units and conversions to better serve KW's global customers. Moreover, future versions will be available with select foreign languages.

KWPerformance can size units to **multiple design points** and provide users with **multiple solutions** to meet their compression needs. Furthermore, dynamic unit performance is readily available onscreen via dynamically adjusting pressures, temperatures, speed, variable volume pocket positions, activating and deactivating cylinder ends, and even bypassing entire compression stages. Unit performance is calculated and displayed instantly.

For users needing even more power (curves, 3D plots, full map reviews, tabled data, etc.), KWPerformance™ can generate eRCM Viewer™ files, which are the unparalleled staple for compression modeling in our industry.

For more information on Knox Western reciprocating compressors, please browse to www.KnoxWestern.com. Contact Knox Western for more information regarding official software release date: (814) 459-2754, or sales@knox-western.com.

In Development: ACI is currently developing OEM performance software for another, high-speed reciprocating compressor manufacturer. Along with eAjax™ and KWPerformance™ software, this makes ACI the leading resource for OEM software design, implementation, and maintenance.

ACI Acquires Gas and Air Specialty Products

Acquired in 2008, the GAS Products Division of ACI Services offers an exciting range of efficient poppet valves and highly efficient unloaders for reciprocating compressors. ACI's patented radial single deck and sleeve unloaders provide very low parasitic horsepower unloading, while also providing very efficient operation in the loaded mode. Combined with Radial suction and discharge valve, this combination may provide as high as a 15% to 18% increase in capacity in cases where 3-4 cylinder ends are operated in the unloaded mode in low pressure ratio applications.

The GAS Products Division also provides pressure balanced, air actuated upgrades for gas actuated clearance unloaders. Frequently the cost for these upgrades is less than reconditioning the gas actuated systems. These are custom designed and manufactured for each application.

The GAS Products Division offers replacements wear parts and valve reconditioning for a wide range of OEM and third party valves. These incorporate the materials and design features developed through GAS' own proprietary valve product lines.

The GAS Products Division continues to operate from the same western Missouri location where it originated over two decades ago.

See additional details on these products at www.GASProducts.com.

Rotating Radial Valve End-Deactivator

GAS Products

A Division of ACI Services, Inc.

1931-A West 40 Highway

Blue Springs, MO 64015

Phone: (816) 224-0544

Ariel Announces ACI as an Authorized Parts Distributor

Through the years, ACI and Ariel have formed a long lasting partnership. ACI has proven to be reliable strategic supplier to Ariel by providing valuable compressor engineering and manufacturing of all automatic volume clearance pocket unloader assemblies for Ariel compressors. To date, ACI has designed and manufactured thousands of unloader assemblies.

ACI is pleased to further offer our resources to Ariel as an Ariel Authorized Parts Distributor. As an Ariel Parts Distributor, we are committed to providing the same level of customer support and world class service that the market has grown to expect.

Please contact Chuck Kerr at 740-435-0240 ext. 526 or ckerr@aciservicesinc.com for more information.

Ariel Corporation

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Mount Vernon, OH 43050

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E-mail: info@arielcorp.com

For a limited time, ACI will include the following incentive offer with all Unloader quotes (other components do not qualify for this offer):

A. Any single purchase of at least US$30,000 of ACI unloaders will earn the purchaser a one-year rental of one eRCM™ license, including maintenance, at no additional charge [US$9,600 retail value]. Training is available at standard quoted rates; or

B. Any purchase of at least US$120,000 of ACI unloaders in a 12-month period (no retroactive period allowed) will earn the purchaser a two-license eRCM™ software pack at no additional charge [US$30,000 retail value] upon purchase of one year of maintenance at the standard rate of US$2,700. Training is available at standard quoted rates.

ACI's eRCM™ software is the most advanced reciprocating compressor performance prediction and automation analysis software available in the market. Please visit www.ACIServicesInc.com for more product information.

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The Innovation Resource for Reciprocating Compressors

www.ACIServicesInc.com

Norm's Notes

Thanks to the loyalty and confidence of our customers and the dedication of our team, ACI has continued to grow as the preferred solutions provider for reciprocating compressors. The GAS Products line further broadens our compressor load and flow control product portfolio into the absolute best in the industry. Our collaborative pioneering development of the last three years with Optimum Power Technology, PulseBusters™ pulsation attenuation network (PAN) technology, recently completed field validation at an El Paso station and is ready for selected commercial applications. More exciting products are being prototyped and evaluated using our recently commissioned closed loop reciprocating compressor test facility. Besides our major commitment to product development, investments in additional plant space, equipment and increased crane capacity at our Cambridge headquarters have expanded our manufacturing capacity.

Although with sadness we note the passing of our former owner, Jack Youngs, on May 2, 2009 earlier this year. We celebrate his vision and his dedication to innovation as ongoing hallmarks of our business.

W. Norm Shade

Excellence is not a skill. It is an attitude.—Author unknown