Compressor Works

ACI Services, Inc.

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Compressor Connection

A Resource of ACI Services, Inc.

ACI Services, Inc. started the year off with some fanfare. Beginning in January 2005 ACI Services, Inc. expanded the line of services they offer to the compression industry. This new venture will involve ACI in the used compression equipment market. The marriage of this new business with the already well known ACI engineering expertise in compressor applications will open up the used equipment market. A major part of this venture is based on the availability of used equipment. As you will see a web site was chosen as the primary tool for supporting this venture. This provides a platform for the end user to search the inventory of parts and make an inquiry on a part. This can all be accomplished in a few minutes from the comfort of your office. From this one inquiry, ACI will locate the part and make all arrangements to put this part in the hands of the end user. No more chasing several leads and making endless phone calls.

Joining the ACI team in January 2005 to lead the efforts in the used equipment market is Tom Drenan. Tom brings with him a career that spanned 24 years with Tennessee Gas Pipeline Company and the natural gas transmission industry. With experience in the operation, maintenance, engineering and management of compressor stations Tom has the background that is needed to drive this new project.

Like any new business, we first needed a name. A name that not only defines the purpose of the business, but also has ring to it like a radio jingle, easy to remember, and makes you think of ACI Services. After input from several people, the name, ***Compressor Connection*** was chosen as the new business name. ***Compressor Connection*** makes the connection between a user's compressor problem and a solution.

With a name in hand, and a business plan a flow chart was generated which spelled out the needs of the project and how the various facets were to work as one. From its inception, ***Compressor Connection*** was to provide a service like no one else in the used equipment market. ACI will locate used equipment for a client, handle the disposition of equipment and engineer a new solution to an old problem by reapplying used equipment for the same client. An important feature is how ACI would make all this equipment available to the end user. It was decided that a web site would be the right platform to manage the vast listing of parts available. With the ever changing times in the compression industry the approach had to be user friendly for the user. ***Compressor Connection*** allows the user the freedom to make one phone call or inquiry through the web site. From that point on ACI handles the work involved in the transaction. All changes to the inventory and updating of the web site will be managed by ACI. The inventory can be found at **www.CompressorConnection.com.**

Compressor Connection offers three (3) areas where we can help the end user. They are as follows:

Locating replacement parts
Compressor owners and operators can connect to the website and select from an extensive list of good, serviceable, used compressor equipment. Locating, packaging and shipping are all handled by ACI.

Selling excess equipment
ACI Services will manage the sale of excess parts or equipment inventory and retired equipment in your company. Turn the retirement of facilities into a profit that offsets the cost of demolition.

Re-application of equipment
Let ACI engineers re-cylinder your equipment with used cylinders. By re-cylindering, product throughput can be increased while maximizing fuel efficiency. When the application absolutely demands it, ACI can also design and manufacture new, custom cylinders for virtually any compressor make, model and application.

Compressor Connection and ACI hope that you take a look at our latest venture and let us help you solve your compression problems. You will find that ***Compressor Connection*** can become a useful tool for you in addressing your maintenance needs. Go to our web page at **www.CompressorConnection.com** or call and talk with Tom Drenan at 740-685-8784 x509 with any inquiries, comments or suggestions you may have concerning ***Compressor Connection***.

Inside this issue:

Look for ACI at these Events:

May 10-12 Eastern Gas Roundtable Conference; Robert Morris University, PA

October 3-5 Gas Machinery Conference; Covington, KY

ACI is presenting a new short course, ***Performance Control of Reciprocating Compressors: Devices for Managing Load and Flow*** *for presentation in October 2005 at the Gas Machinery Conference in Covington, KY. This will include a comprehensive review of the methods and devices available for compressor control; an objective comparison of their relative benefits and limitations; and guidelines for comparing, selecting and economically justifying the optimal approach for a specific application.*

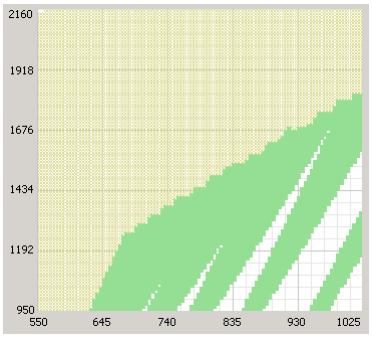

Figure –1 (90 MMscfd)

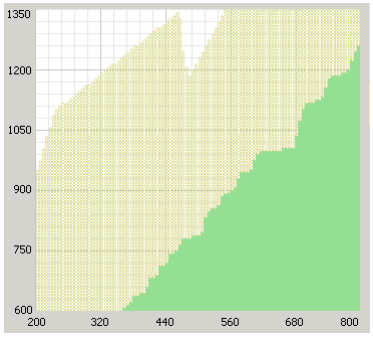

Figure –2 (40 MMscfd)

Compressor Performance and Optimization—Flow Maps

Using a consistent compressor performance model is critical for many end users in the natural gas compression industry. The same model should be able to: help operators locally control the compressors; help automation specialists create PLC code to monitor and control units; provide abilities for engineers to review cases and model *What-If* scenarios; and should allow for Gas Control to accurately predict how much flow their stations, or individual units, can deliver based on current or expected conditions.

Flow maps are one particular tool that can prove to be very valuable to Gas Control. These maps can be generated in seconds using today's high-end performance software.

Flow maps are typically Suction Pressure plotted against Discharge Pressure, and the output is usually based on average, or specific, suction temperatures. All valid combinations of Load Step and speed (RPM) are considered in determining if a particular unit can deliver a specified flow rate.

Figure-1 shows a flow map were the unit (fixed-speed, 6-throw, single stage) can achieve 90 MMscfd. Areas in yellow are where it can achieve less than 90 MMscfd while areas in white represent unsafe operating areas or areas where flow rate is non-obtainable.

Figure-2 is a flow map of a GMV-6 (variable-speed, 3-throw, single stage) unit based on a request of 40 MMscfd. Thus, if inlet pressure to the station is 440 psig and required discharge pressure is 1050 psig, then this unit will not be able to satisfy the flow requirements.

Flow maps are ideal for Gas Control. Typically, Dispatch desires a flow rate and wants to know if the unit/station can deliver that flow rate based on current or expected operating pressures. With a flow map, Gas Control can make that call with ease. Then, it becomes the task of the automation system, or the station operators, to adjust the unit's load steps and/or speed to achieve the desired flow rate.

In the next issue we will discuss using Safe Startup Maps. These maps detail those operating conditions for which you can safely startup your compressor.

New ACI cast ductile iron, jacketed 150 psig MAWP, 10.0 in. bore, 11.0 in. stroke, second stage cylinder.

New ACI cast ductile iron, jacketed 150 psig MAWP, 7.0 in. bore, 11.0 in. stroke, third stage cylinder.

Project Success Story

A North American chemical plant utilizes several motor-driven Worthington single-throw 11-ESH compressors in acrylonitrile and butadiene production processes. Three stages of compression were block mounted on individual cylinders on each single-throw compressor frame. The compressors have been in service for many years and several of the cylinders had excessive wear and leakage tendencies.

In 2004 ACI Services was contracted to evaluate, recondition and re-rate the second and third stage cylinders from one of these compressors. ACI's investigation revealed that the cylinders were unsuitable for continued use. The customer was advised of the findings and an emergency repair procedure was developed and proposed. ACI also proposed new, bolt-in replacement cylinders to eliminate the problems that were inherent in the original cylinders.

In order to get the customer's unit back in service until new cylinders were available, ACI reworked the original cylinders and designed and manufactured special shouldered studs with o-ring seals to seal numerous gas and coolant leaks in threaded holes in the valve and main bolting flanges. Kalrez® o-rings were required for compatibility with the process gases. The cylinders were completely cleaned and the liners were honed. All new fasteners were manufactured and installed, and gas and coolant sections were hydrostatic tested at 1.5 times maximum working pressure. These reconditioned cylinders were then returned to the customer for emergency use until new cylinders were available.

Concurrently, ACI designed and manufactured new second and third stage, water-jacketed cylinders as bolt-in replacements for the original 11.0 in. stroke Worthington cylinders. Both cast ductile iron cylinder designs were rated at 150 psig MAWP, with the second stage having a 10.0 in. bore diameter and the third stage a 7.0 in. bore. ACI designed the cylinders to accommodate the customer's existing compressor valves, piston and rod assemblies and packing cases. ACI also designed and manufactured new valve caps and cages to improve sealing, maintainability and pressure rating, as well as new ACI maintenance-friendly slip-fit liners to improve serviceability. Kalrez® o-rings were used throughout the assemblies.

Product Highlight—Exacto Torque™

Another innovation from ACI.

THE PROBLEM

- Most piston rods need to be torqued to a pre-stress of 30,000 psi.
- Conventional fasteners require unwieldy and occasionally hazardous application tools.
- Galling between the nut face and crosshead face often results from turning these faces against each other at the required torque levels.

THE PROVEN SOLUTION

- ***EXACTO TORQUE***™ pre-stresses the rod in the same manner as a conventional hex nut.
- Computer stress analysis assures proper quantity and size of jack bolts, seated on individual bearing pads.
- Accurate preload is applied and face to face galling is eliminated.
- Mated spherical surfaces on the pad and jack bolt allow perfect alignment of the nut to the crosshead face.

ACI designed Exacto Torque™

Cross sectional view highlighting the jack bolt and pads.

ACI Canadian Connection

ACI is proud to be a part of the Canadian Natural Gas Industry. We have partnered with four prominent firms in Canada, Syntech, Klaus Enterprises, Garth Warren & Associates, and Beta Machinery Analysis.

Syntech is the official licensee for ACI's eRCM™ compressor performance software in Canada and for use in packaged compressor control panels worldwide. Syntech reached a significant milestone early this year when they shipped their first compressor package control systems featuring ACI's software and its special compressor control and performance curve display capabilities. Syntech is a division of Enerflex, Ltd., a valued customer of ACI for many years.

Klaus Enterprises is our official distributor of ACI hardware products in Western Canada.

Garth Warren & Associates is our official sales agent in Eastern Canada.

BMA is our partner for digital acoustic pulsation studies and other technical services.

***You can't solve today's problems with the same kind of thinking that created them* - John Chapman, retired President, CCV**

ACI Team Member Profile — Dwayne Hickman

Dwayne has over thirteen years of experience in compression-related programming, computer training and website development. Within the last five years, ACI's software division has released over twelve software applications to meet the varied and demanding needs of our customers.

In early 2000, ACI was challenged with creating reciprocating compressor performance software that would smoothly integrate ACI's technical experiences and knowledge with actual needs of the gas compression industry: unit unloading issues, dynamic performance curves, pulsation adjustments, automation issues, PLC-based unit modeling, features for gas control, unit-to-unit staging issues, entire station modeling, etc. Dwayne spearheaded this project and the resulting software, eRCM™, quickly set a standard for the industry.

Listening to and addressing the needs of customers is one of the core traits of ACI employees. For Dwayne, this quality developed and refined with years of teaching. After graduating from The Ohio State University, Dwayne taught college at OSU's main campus and their branch campus in Newark, Ohio for over twelve years. Today, you will likely find him giving technical, compression-related presentations at conferences such as the Gas Machinery Conference (GMC) and the International Pipeline Conference (IPC).

For answers to your compressor performance questions, call ACI and ask for Dwayne at x508.

Dwayne Hickman

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The Innovation Resource for Reciprocating Compressors

www.ACIServicesInc.com

Compression Problem Solvers

- Manufactured Products
- Custom Design Work
- Field Service and Consulting
- Pulsation Studies
- Software Products

Compression is our world. That's why we are called to solve some of the toughest problems in compression. At ACI Services, we have resources, the people and a track record of accomplishments to help you with your most difficult compressor-related issues. In addition to our production hardware and software products, we design and manufacture custom products: cylinders, unloaders, automatic variable volume pockets, pistons, rods, liners, and specialized software to analyze and control compression systems. Our engineering and field services are helping end users get the most out of their compression equipment in production and process applications around the world.

A Note from ACI's Business Leader—AKA Norm's

ACI Services has a number of exciting new developments so far in 2005! We have expanded our channels to market, with the addition of Klaus Enterprises as our aftermarket distributor for western Canada and John Burroughs as our sales agent for the U.S.A. Rocky Mountain region. We welcomed Klaus, Burroughs and our other area sales representatives to Derwent for our first annual Sales Meeting on April 20.

We continue to add experienced and talented depth to our Derwent team. Chuck Wiseman was recently named Director, Mechanical Design. Chuck, with an MSME from Ohio University, comes to ACI with 16 years of compressor engineering experience. Lou Brahler, who recently obtained his MBA from Geneva College, brings 26 years of industrial management experience to his position as Production Manager at ACI. Bob Dunkle, Production Specialist, joined our team early this year with 20 years of industrial management and production experience. And Tom Drenan, with a BSME from the West Virginia Institute of Technology, comes to ACI with 24 years of pipeline compression engineering and station management experience to fill the new position of Director, Compressor Connection.

With the prevalence of high speed compressors in the compression industry today, ACI has continued to strengthen its engineering analysis tools. Accordingly, we are currently phasing out our SGA analog computer and moving entirely into digital services. Through an alliance agreement with Beta Machinery Analysis, ACI will continue to provide high-quality and cost-effective acoustic pulsation studies, along with an expanded portfolio of technical services such as torsional studies, finite element analyses, thermal analyses, and field vibration and pulsation analyses.

We are delighted with the confidence that our customers have shown in ACI's products and services. We are enjoying an exceptional rate of growth at the current time. With growth comes other challenges, such as finding more good people with the right skill sets and providing enough office and production space for them to work in efficiently. We've been fortunate to find quality people to support our business and serve our customers, and now we are looking at several options for a larger and more efficient facility. But that will make a good story for the next issue of *Compressor Works*!

***Vision without action is merely a dream. Action without vision just passes the time. Vision with action can change the world* - Joel Barker**