One of two Cooper/Superior Model 2406G natural gas-fueled engines rated at 1200 bhp (895 kW) at 1200 rpm at EnCana's Brighton compressor station. Each engine powers a Cooper Model 425CC natural gas compressor.

CONVERTING 20TH CENTURY COMPRESSOR AND ENGINE CONTROLS WITH 21ST CENTURY TECHNOLOGY

Enginuity, LLC Supports Modernization of EnCana 100 Lateral Compressor Station in Brighton, Colorado, U.S.A., with iFLEX 500 Intelligent Engine Controls

By Jack Frese

In 2004, due to reliability issues, downtime, loss of revenue and increased overall costs, EnCana chose to upgrade one of its two existing engine compressor systems at their Lateral 100 Gas Gathering facility, located in Brighton, Colorado, U.S.A. Enginuity, LLC was chosen from among a few select companies to provide a turnkey solution, including engineering, installation and commissioning. To meet its customers' business drivers, Enginuity focused on the system most directly affecting engine reliability, the existing electronic and pneumatic controls and end devices.

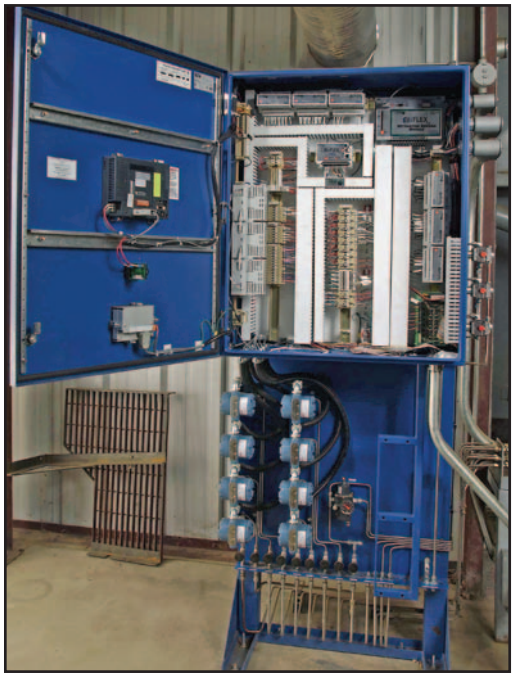
The 100 Lateral Gas Gathering facility was built in 1991 and equipped with two Cooper/Superior Model 2406G natural gas-fueled engines rated at 1200 bhp (895 kW) at 1200 rpm. Each powered a Cooper Model 425CC natural gas compressor. The units were equipped with the latest electronic controls and end devices available at the time. The facility was designed to operate unattended.

Even with two complete units at the facility, it was very seldom that both units were available to move gas at the same time. Most often one was online while the other one was down due to mechanical or electronic problems. Getting the units online was half the issue, once online, keeping them there and moving the required amount of gas was the other half. With changes in the gas field, EnCana had the opportunity to gather more gas and the limitation now became the engines.

According to Enginuity, EnCana realized that the existing electronic controls could no longer operate the units to meet the new demands placed upon the compressors. The existing control, if running, could not operate engines above or below 1140 rpm at 67% torque load without shutting down. Engine speed would vary +/- 50 rpm. Vibration and outdated end devices were also a part of the problem.

As conditions deteriorated, the unmanned facility began to require inspection and visits by operation personnel and service companies almost daily. The units were operating at less than 70% uptime.

Since 1991, there have been many innovations in electronic controls and supporting end devices that made it practical to optimize the Brighton facility. EnCana determined that the compressors and engines could deliver many more years of service, so rather than spend several million dol-



All inputs and outputs on the new panel are fused for additional protection. In addition, all internal wiring is labeled for simplified troubleshooting and the panel is Class I Div 2 Group D approved, NEMA 4 rated.

lars or more for an all-new facility, the company chose to perform an upgrade.

Enginuity and EnCana combined multiple technologies to provide a complete system that delivers easy engine starting, precise control at required setpoint and remote monitoring and control. According to Enginuity's Jay Holden, business development director, and Kevin Davies, manager of Enginuity Services, the company had a set of clearly defined objectives to meet and successfully complete EnCana's modification upgrade. They included improved control performance, remote operations and monitoring, reduced emissions, reduced maintenance, increased reliability, increased efficiency and easy troubleshooting.

First, all end devices were checked and evaluated and all electronic and pneumatic control equipment for both engine and compressor were removed and inspected. Serviceable devices capable of supporting the converted systems were used wherever possible. Reused sensors and other components included compressor lube no flow, engine oil level, compressor oil low level, engine jacket water surge tank low level, engine vibration, cooler vibration and detonation.

Other sensor components that were reused included liquid level fuel gas scrubber high, liquid level suction scrubber high, compressor oil temp high, compressor discharge temps/high, engine oil temp, six engine cylinder exhaust temp and engine air manifold temperature.

In addition, Enginuity installed a number of new iFLEX devices as part of the upgrade. They included a new governor valve, Pre Combustion Chamber (PCC) control valve, Wastegate actuator for air/fuel ratio control, PCC differential pressure transmitter, Micro Motion mass flow sensor, FW Murphy ignition (MPI) system and magnetic pickups.

Installation of the new iFLEX 500 panel was a key element of the upgrade that resulted in a number of new features as well as enhancements to traditional panel functions. For example, the control panel includes start/stop sequencing capabilities to safely allow prelube, warm-up and soft loading as well as providing an orderly soft or hard engine shutdown. All sequencing is controlled via operator or remote commands. The panel has an integrated full function touch screen in color for visual recognition and clarity of each function.

The control system maintains constant air/fuel ratio via wastegate control. Compressor load is controlled by closing the unit bypass valve and varying the speed set point of the engine using PID control.

Other features of the new panel include speed governing, which formerly was controlled by the governor fuel valve to maintain the speed setpoint using PID control; engine and compressor protection monitoring to provide alarming and shutdown functionality, which alerts the operator when values approach problem levels. Also included were a pre-combustion controller and a differential sensor with a range of 0-100 in. H_20 to determine pressure setpoint based on fuel flow. An integrated readout in lbs/h from the Micro Motion mass flow sensor (for gas measurement) gives accurate mass flow rate and compensates for changes in gas quality.

The system also includes a Murphy Power Ignition (MPI) system with interface screens to monitor faults, resettings, spark plug voltages and energy levels, spark plug changeout, care of leads, dielectric grease, gapping plugs and lubrication and catalytic converter monitoring for temperature and differential pressure.

Modifications and other changes included a new fuel manifold header to equalize pressure at both ends and rerouted fuel piping to accommodate the Micro Motion flow sensor and governor valve plus new Pre-Comb control piping.

Panel controls contain an iFLEX iPM central processing unit (CPU) and iFLEX Input/ Output (I/O) modules; a detonation sensing module processor (DSM); an integrated instrument rack; a ProFace human machine interface (HMI); and USD button and lockout. The panel acts as a Modbus Slave and has an ROC 809 that is set up as a Modbus Master to poll data and capable of giving remote commands, which was one of EnCana's requirements.

The panel is fused for 24 Vdc distribution for MPI; in addition, inputs and outputs are fused for additional protection. All internal wiring is labeled for simplified troubleshooting and the panel is Class I Div 2 Group D approved, NEMA 4 rated.

With the engineered modifications described above now complete, EnCana can use SCADA to monitor this compressor facility from 35 mi. (56 km) away at its Fort Lupton, Colorado, headquarters. It is now operating as an unmanned facility except for an occasional check once a week or less. EnCana reports that the efficiency of the modernized unit has increased 30%.

Downtime due to electronic instrument failure has been eliminated, according to the company. Modernization of the one unit with iFLEX 500 controls and new end devices has met EnCana's criteria for success, and most of the operators' past problems have now been solved.

When it was founded 10 years ago, Enginuity's mission was to help gas pipeline companies meet the stringent regulatory guidelines controlling nitrogen oxide (NO_X) exhaust emissions of the engines used in the gas transmission process. As the regulatory climate began to shift from rule promulgation to emissions reduction implementation, Enginuity's focus shifted accordingly. The company began developing and testing technologies and performance control solutions to help customers meet the new regulatory challenges, while concurrently increasing efficiency and performance, decreasing operational costs.

With a focus on combustion fundamentals, Enginuity began retrofitting large bore stationary gas engines to solve customer performance, maintenance and compliance issues. Retrofits include conversion of naturally aspirated and mechanically blown engines to pure turbocharger configuration,

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engine control based on thermodynamic principles, automation, engine and systems monitoring. Since 1996, Enginuity has completed approximately 160 engine retrofits including 27 engine makes and models.

In recent years, the company has entered new markets with the introduction of "intelligent" medium- and high-speed engine controls. The intelligent engine family of products includes monitoring and control solutions for a wide range of engines in both compression and power generation applications. The product line includes: iMPACT performance monitoring; iBALANCE power monitoring and iFLOW compressor monitoring; iVIEW diagnostic software package; iFLEX engine control platform and iCS air/fuel ratio controller for natural gas engines. ■

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