

VALUE PROPOSITION

PETROCHEMICAL INDUSTRY

SOLUTIONS

- Solution provider
Rockwell Automation
- Variable Frequency Drive with synchronous bypass system
 - PowerFlex 7000® 18-pulse, 2500hp (750kW), 4160 volt drive
 - Synchronous transfer solution provides a low-cost and space efficient system to start and operate two centrifugal pump motors with one drive system

RESULTS

- Operations impact
 - Less stress, less maintenance and longer life of the motor and driven equipment.
- Power system impact
 - Drive system efficiency is 97% at full load, full speed (VFD and isolation transformer)
- Financial impact
 - 33 per cent less capital cost for synchronous system and two motors compared to multiple drives.
 - 9-month to 2-year payback period for controlling the output of a pumping system with a medium voltage VFD instead of throttling with control valves.

Conoco Phillips Petroleum saves capital costs and energy with medium voltage drive solution

MONTANA OIL PIPELINE ORIGATION/INJECTION STATION REDUCES CAPITAL COSTS BY 33 PERCENT AND SAVES ENERGY WITH A POWERFLEX 7000 VARIABLE FREQUENCY DRIVE AND A SYNCHRONOUS TRANSFER SYSTEM.



BACKGROUND

A 127-year-old company knows what it takes to remain competitive in a changing world. Conoco Inc., the third largest oil and gas company in the U.S., (which merged with Phillips Petroleum Company in August 2002) owes its success to knowing when to embrace

advanced technology while keeping production costs down. Headquartered in Houston, Texas, the company has subsidiaries in 40 countries and employs 20,000 worldwide. Its operations include exploration, production, refining, marketing, supply and distribution of petroleum products.

In June 2001, the company expanded again with the construction of a new crude oil pipeline origination/injection station in Buffalo, Montana, built along an existing third-party pipeline extending from Alberta, Canada, to Montana.

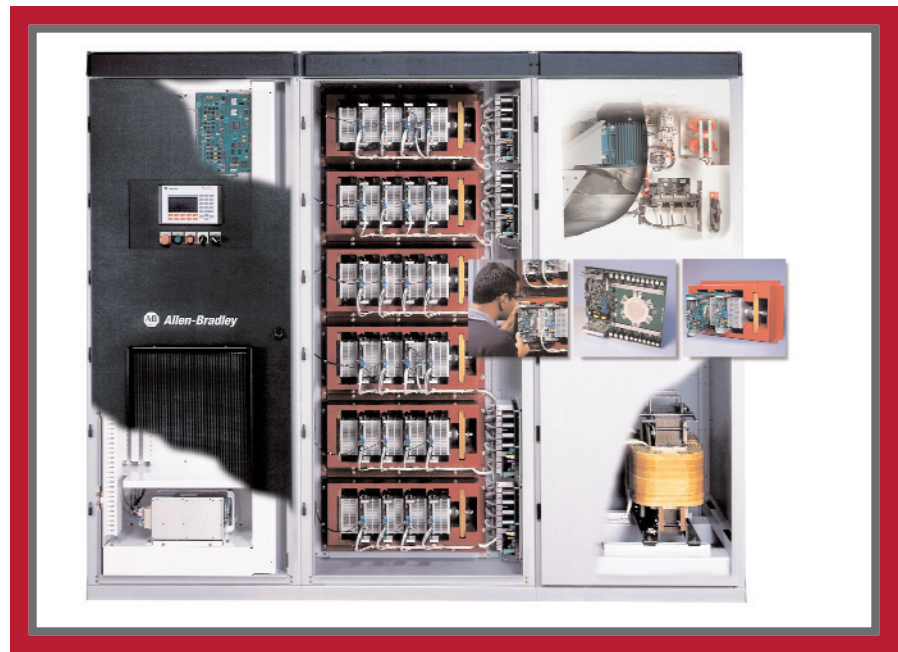
CHALLENGE

Flexibility was key in choosing the station operating mode. Because the crude oil either originates out of tankage into the existing pipeline or is blended into the crude oil flowing upstream, the station pumps a wide range of crude oil types at various flow rates, viscosity and density. There were five different pumping scenarios to be considered. It was important to Conoco to reduce the number of pumps and motors necessary and not have excessive throttling. All these items would affect initial capital costs, energy efficiency and the corresponding long-term costs. Time constraints were also a big challenge, as the station had to be complete and fully running within 12 months.

To provide the right solution, Conoco turned to Rockwell Automation. The Rockwell Automation team worked to find a motor and control solution that was both economical and flexible.

Traditionally, pumps and motors are operated at fixed speeds, designed for the maximum quantity of oil pumped through the system and do not cost-effectively allow for flow variety. Mechanical devices such as throttles or fluid couplings can be used with fixed speed motors, however the motor will continue to operate at its maximum speed.

This difference between the power output at fixed speed and the actual required power represents savings potential.



Rockwell Automation helped Conoco save capital costs by using one Allen-Bradley PowerFlex® 7000 drive to operate two motors.

One large pump was considered to reduce initial costs, but it would be inefficient at low flow rate cases, and overall optimization and reliability would be effected.

SOLUTION

Conoco and Rockwell Automation's cost effective solution was to use two centrifugal pumps of different sizes to accommodate the differing flows, and a variable frequency drive (VFD) with synchronous bypass to control the motors. This combination allowed for the best efficiency during normal operation between the five pumping scenarios and limited flow rate backup operation if one motor failed. "The drive is a huge energy saver," said Conoco's Technical Excellence Leader, Rodney Kottwitz, "because we're not throttling off the pressure."

A control valve option would have required three or four different motor configurations to meet the different scenarios without excessive throttling, resulting in energy loss of the throttled pressure and a large increase in capital. The team chose a 2500 hp Reliance medium voltage motor to originate out of tankage and a 1500

hp Reliance medium voltage motor for blending crude oil into the flowing pipeline. Typically a separate drive is used to start and control each motor, but drives are a large capital expenditure. The answer was to use one 2500 hp Allen-Bradley® PowerFlex® 7000 AC variable frequency drive with 18-pulse rectifier and a synchronous bypass system. The 18-pulse drive eliminated the need for harmonic mitigation in meeting IEEE-519 standards, and the synchronous bypass option allowed operation of either motor on a single VFD to control flow rate and pressure of the pipeline.

With a VFD, torque levels applied to the rotating equipment during starting are reduced. The VFD controls the speed of the motor/pump, so that it always precisely corresponds to the flow rate actually required and therefore only draws the power required. Also, a VFD reduces equipment vibration during starting and stopping while pressure surges are reduced or eliminated. Overall, using a VFD to start and control the pumps results in less stress, less maintenance and longer life of the

motor and driven equipment. The PowerFlex 7000 offers the additional benefit of being smaller than its predecessors, thus saving valuable floorspace in the station.

The synchronous bypass system is a real advantage compared to using a separate drive for each motor. The synchronous bypass method uses only one drive to start and synchronize both motors through the process of transferring a load from one source to another by matching the voltage waveform frequency, amplitude and phase relation between the two sources. The synchronous bypass is more energy efficient than multiple drives and has the additional benefits of preventing voltage drop, vibration problems or process disturbances.

“To us, the energy savings was a bonus,” said Kottwitz. “The primary savings were in reducing the number of pumps and motors and eliminating excessive throttling.”

The Rockwell Automation solution also incorporated a SCADA system to

control the flow rate and a programmable logic controller with PID control blocks to control the drive speed. The PowerFlex 7000 drive allows communication with the PLC using the PanelView 1000 MMI, which then communicates to Conoco’s main SCADA control center in Houston.

RESULTS

The station was completed in June 2001 and has been in production using the PowerFlex 7000 drive with synchronous bypass system successfully since.

The economic advantages of the VFD with a synchronous bypass are in both installation costs and operating costs. A synchronous system for two motors costs 33 per cent less in initial capital outlay compared to multiple drives. A synchronous transfer system will also avoid the drive efficiency losses when compared to multiple drive systems. A nine-month to two-year payback period is typical when medium voltage VFDs are

applied to control the output of a pumping system instead of throttling with control valves.

Conoco personnel are convinced of the cost savings and benefits of the system. “Capital cost savings were based on not having to buy two or three additional pumps and motors,” said Kottwitz. “\$100,000 per motor and \$100,000 per pump, plus associated valves, accessories and installation – you’re talking a significant amount of money compared to buying the drive.”

The results mentioned above are specific to Conoco Phillips’ use of Rockwell Automation products in conjunction with other products. Specific results may vary for other customers

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