

APPLICATION PROFILE

NATURAL GAS INDUSTRY

SOLUTIONS

Variable Frequency AC Drive

- PowerFlex 7000 medium voltage drive for 6.6kV motor
- The PowerFlex® 7000 Direct-to-Drive technology does not require input or output transformer for a 6.6kV line.
- Existing motor and motor cables can be used with Directto-Drive™ technology.
- Small footprint of PowerFlex 7000 allows installation in an existing control room.

RESULTS

Energy savings of 37% on high-pressure pumps

- The PowerFlex 7000 offers increased efficiency and reduced harmonic distortion.
- Reduced capital costs and installation costs associated with using existing motor, cabling and control room.
- Reduced capital and installation costs by eliminating purchase of transformer.

Rockwell Automation helps Fluxys LNG achieve energy savings

TAKING ADVANTAGE OF NEW DRIVE TECHNOLOGY FROM ROCKWELL AUTOMATION, FLUXYS LNG RECENTLY BECAME ONE OF THE FIRST LNG PLANTS TO EMPLOY A VARIABLE SPEED DRIVE TO CONTROL A HIGH-PRESSURE LNG PUMP.



Fluxys LNG Zeebrugge, Belgium employed PowerFlex 7000 medium voltage drives for energy savings on its high-pressure liquefied natural gas (LNG) pumps.

BACKGROUND

Fluxys LNG Zeebrugge, Belgium is a major hub for the transportation and storage of liquefied natural gas (LNG) in Europe. Fluxys transports gas from Norway to Zeebrugge by

submarine pipeline, where it joins the interconnecting link with the United Kingdom that enables natural gas to be traded via the "Huberator" hub. There are two further LNG plants at Zeebrugge; the peak-shaving site, which

operates on standby and whose task is to balance out any consumption peaks in winter, and the LNG terminal.

The LNG storage terminal receives liquefied natural gas by tanker ship at -160°C , and at an operating pressure of 110-150mbarg. Currently, the terminal receives some 60 tanker deliveries per year, but a planned expansion in 2007 will see this figure rise to 110. The LNG is pumped from the tankers into one of three storage tanks, each capable of holding $87,000\text{m}^3$ – a fourth tank with a capacity of $140,000\text{m}^3$ is currently under construction. While it is being pumped, return gas or volume displacement gas is sent to the tanker to equalise pressure in the storage tanks and in the vessel's tanks.

The LNG is moved from low-pressure tanks through high-pressure pumps, which increase the pressure to 80barg – the transport pressure on the natural gas network. This pressurised gas is then vaporised in evaporators that raise its temperature from -150 to 3°C . The heat required for this process comes initially from burners immersed in the water bath of each evaporator, and finally from a co-generation plant consisting of a 40MW gas turbine with 72MW heat recovery. The hot water generated by this process is re-injected into the evaporator water bath.

CHALLENGE

As part of a schedule of upgrades – intended to improve plant efficiency and reduce maintenance costs – Fluxys LNG decided to examine the feasibility of using a medium-voltage drive on one of the high pressure pumps used to transport LNG into the storage tanks. The aim was to obtain the desired flow rate of LNG by controlling pump speed rather than



A medium voltage drive was installed on two of the five pumps and on the compressor providing the return gas to the ships' tanks. The compressor and the ice on the unit can be seen in the centre of the photograph.

the existing method of regulation valves. The use of a variable-speed drive in this way would afford considerable power savings and, thanks to lower wear on the pump, a reduction in maintenance costs.

SOLUTION

Given the importance of a natural gas supply, any technology implemented had to be proven. In 2004 an implementation plan was set up to replace the inefficient "pressure control/regulation valve" – a high consumer of energy – with a 6kV, 1.4MW medium-voltage drive to control pump speed directly, thereby improving operating efficiency. Fluxys LNG wanted the most advanced medium-voltage drive technology available. A market study carried out as part of the tender process revealed that most drives employ a step down/step up of the drive voltage requiring a 6kV transformer at both input and output. Transformers take up more space than the drive itself and require the additional capital and running costs of air conditioning due to heat losses. However, one supplier – Rockwell Automation – was able to

offer an alternative. The Allen-Bradley® PowerFlex® 7000 Direct-to-Drive™ is the latest addition to the comprehensive PowerFlex family of drives. Thanks to the latest developments from Rockwell Automation, the PowerFlex 7000 Direct-to-Drive requires no input or output transformers allowing greater operating efficiency while enabling considerable space savings.

In view of the environmental hazards, an isolation transformer was required in this case to limit contamination on the network. However, since only one such transformer was required, the overall cost of the PowerFlex solution was comparable with that of less advanced "traditional" drives, allowing Fluxys LNG to benefit from the most advanced technology without additional cost. Installation of the first PowerFlex 7000 18-pulse drive – designed to eliminate 5th, 7th and 11th harmonics – was completed in 2004, making Fluxys LNG one of the first to implement variable frequency drives on a high-pressure LNG pump.

When the Zeebrugge LNG terminal was expanded in 2005, it was

decided to extend the use of medium-voltage drives to include the gas compressors which send the return gas to the ships' tanks. The same compressors are also used to treat gas in the holding tanks at the terminal. The existing regulation system provided flow control between 10,000 and 24,000m³/hour, and so its replacement with a medium-voltage drive solution was a logical choice. Once again, the market was analysed in order to find the most up-to-date solutions and the PowerFlex 7000 Direct-to-Drive medium voltage technology came out as first choice. Once again, Fluxys LNG was among the first to use MV drive technology in this way – an innovative solution using an innovative product.

The PowerFlex 7000 Direct-to-Drive feature combines three innovations designed to eliminate isolation transformers, using either new or existing motors. The first is the PowerFlex drive's use of a

Symmetrical Gate Commutated Thyristor (SGCT), which replaces the thyristor found in a traditional drive's rectifier bridge. Delivering a higher voltage rating and the ability to be connected in series, the SGCT allows the PowerFlex 7000 to be rated up to 6,600V without adding complexity. PowerFlex 7000's Active Front End Rectifier uses active switching and Selective Harmonic Elimination to reduce total harmonic distortion to less than 5% and achieve compliance with IEEE 519, EN61000-2-4 and G5/4.

PowerFlex also features Common Mode Voltage Protection technology designed to mitigate common mode voltage stress generated by variable frequency drives without using an isolation transformer. Since no Reflected Wave Voltage Stress is generated in the motor, the PowerFlex 7000 can be used with older motors, so it is ideal for retrofit applications. Thanks to the high quality voltage and

current sinusoidal at the drive's output, the motor and the drive can be located up to 15km apart without the need for extra motor and cable insulation.

RESULTS

Using the PowerFlex 7000 Direct-to-Drive technology, Fluxys LNG achieved a 37% reduction of energy expenditure on its high-pressure pumps. Installation costs were minimised thanks to being able to use the existing motor and cabling, and eliminating the need for unnecessary transformer and related infrastructure.

The results mentioned above are specific to Fluxys LNG's use of Rockwell Automation products in conjunction with other products. Specific results may vary for other customers.

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