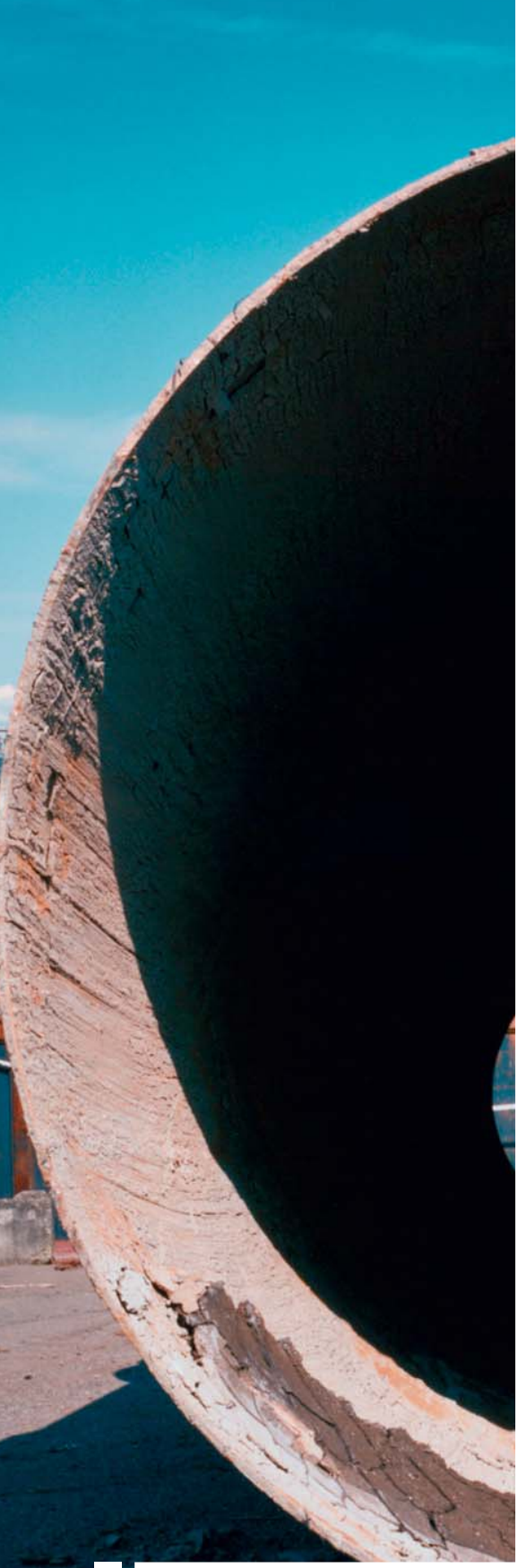

Superior accuracy on fiber reinforced plastic pipes

Using a SITRANS FUS1010 four beam clamp-on ultrasonic flowmeter, a state-owned petroleum company in the Middle East achieves 0.5% accuracy on 138" (DN 3450) fiber reinforced plastic (FRP) pipes. Additionally, flow rates exceeded 26.42 million gallons (100,000 m³) per hour, displaying superior meter performance under very harsh operating conditions.

A petroleum company's utility plant located in the hot and humid Middle East produces and supplies cooling water to a city with numerous office buildings and production sites. The city is currently undergoing such a rapid growth that the demand for cooling water for air conditioning, process cooling etc. has increased drastically.

Background

Since the transformation of this Middle Eastern city from a wild desert to a hub of thriving industries it was realized that tremendous amounts of water would be required for various cooling purposes. The local government drafted a major project using sea water to supply the city with its chilled water needs. Execution was planned to take place in several phases:

Phase I included construction of a common cooling water system providing the city with approximately 81.36 million gallons (308,000 m³) of chilled water/hour.

Phase II was divided into two categories. Category 1 comprised the Front End Engineering Design (FEED) where decisions were made in regards to the usability, performance and cost-effectiveness of the expansion of the cooling water plant and distribution system. During Category 2 these decisions were realized, including the supply of make-up water and reception of the blow down water that circulates the sea water to and from the cooling towers located on each plot.

The future phases III and IV seek to optimize the size, number and layout of the major pipelines and related equipment.

To monitor and control the distribution of water around the facility and from the plant's supply line to the customers, a significant number of flowmeters had to be installed at certain key points. To be taken into consideration for the project, the petroleum company had three main requirements to the flowmeter.

The problem

Given the scarcity of water in the Middle East, fresh and clean water can become more expensive than oil because of the costs associated with producing

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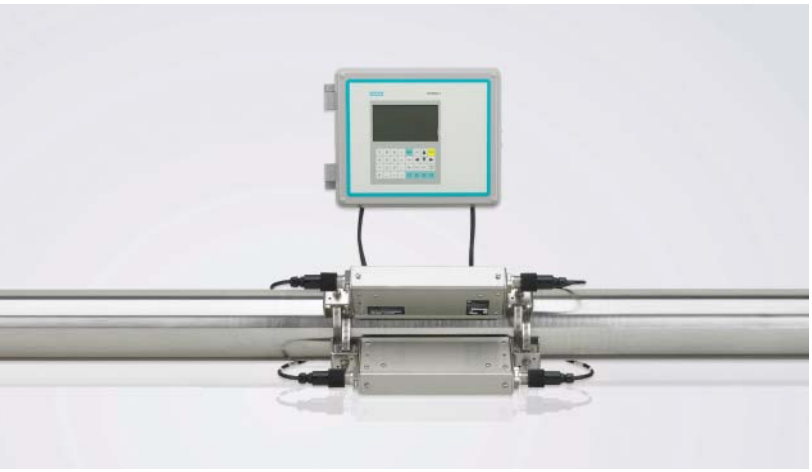

it. For this reason, it was required that the flowmeter's accuracy was 0.5% or better in order to bring waste and unaccounted for water down to an absolute minimum. Since Phase II involved the construction of the distribution facility that directs the water from the water cooling plant to each of the individual industrial customer sites, pipes were extremely large, ranging from 98" (DN 2450) to 138" (DN 3450) in diameter. The chosen flowmeter had to be able to accommodate such sizes. And lastly, being that the Fiber Reinforced Plastic (FRP) and steel pipes were so large, the flow range was calculated to be as high as 26.42 million gallons (100,000 m³) per hour, putting tremendous stress on the flowmeter.

Additional requirements included bi-directional measurement, automatic gain control, four 4-20mA meter outputs, relays to convey faults or failures to a distributed control system (DCS), programmable data logging facility and a couplant suitable for the humid environment. Although these were also important parameters they were not decisive to the same degree that accuracy, flow range and pipe size were.

The solution

Initially, inline ultrasonic meters were being considered but because they tend to become very expensive on large pipes, it was decided to go with the clamp-on ultrasonic technology instead. Because the transducers are mounted on the outside of the pipe, the price of a clamp-on flowmeter is the same regardless of the pipe size it is being installed on. This also makes installation quick and easy compared to other flow measurement technologies.

Due to Siemens involvement in Phase I with a delivery of several dozens of SITRANS FUS1010 clamp-on ultrasonic flowmeters, the customer had extensive experience with this device. They were particularly satisfied with the meters' consistent performance, reliability and ability to measure over a very wide flow range.

As opposed to the Phase I delivery, the FUS1010 would also be equipped with DataView software; a powerful tool for data extraction and compilation through remote or PC access. It can also be used for meter and application diagnostics. For these reasons, the petroleum company decided to use the FUS1010 for both the second and the third phase of the construction project.

To achieve the required accuracy on the FRP pipes that usually pose a challenge to clamp-on ultrasonic flowmeters, Siemens recommended a four beam version of the FUS1010 with universal transducers. For the steel pipes, dual beam meters with high precision transducers, which were also supplied to the first phase of the project, were considered suitable.

Since clamp-on flowmeters cannot be field-calibrated and tests of such large pipes cannot be easily conducted in a lab-type environment, Siemens developed a field verification program for the customer. This enabled adjustment for pipes out-of-roundness (pipes that are not completely round) by measuring the sonic velocity at different pipe orientations. This value is subsequently compared to the known theoretical sonic velocity of sea water, which is a calculation based on temperature and salinity. By going through these procedures, an even higher accuracy could be achieved.

Installing the FUS1010 flowmeters provided several economic benefits for the Middle Eastern petroleum company, including reduced operational and maintenance costs as well as installation time while providing the required accuracy, flow rate and pipe size measurement capabilities.

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