

► Process operators need flow meter solutions that can withstand ever more challenging environments – but which are also cost-effective. Eugene McCarthy reports.

► Bediener von Prozessanlagen benötigen Durchflussmessgerätelösungen, die in zunehmend anspruchsvollen Umgebungen eingesetzt werden können – jedoch ebenfalls kosteneffektiv sind. Eugene McCarthy berichtet.

► Les opérateurs d'exploitation ont besoin de débitmètres adaptés à une conjoncture difficile tout en restant rentables. Selon Eugene McCarthy.

# Flow meter advances driven by harsh environments, accuracy and cost

**F**lowmeters have to withstand harsh, corrosive atmospheres in many process environments. So the latest offerings use new materials that can withstand high pressures and temperatures and offer improved corrosion resistance. At the same time, users are looking for the best mass flow range, pressure drop, and accuracy – all at the lowest possible cost.

One major supplier, Emerson Process Management, now offers its Micro Motion ELITE high capacity coriolis meter in super duplex material to handle corrosive applications and harsh environments (Fig. 1). The super duplex meter is available for line sizes from 200-250mm and improved pressure rating to 160bar.

Super duplex stainless steel offers the same reliability, accuracy and turn down performance as meters made with 316 stainless steel material, with the added benefit of increased corrosion resistance and pressure rating.

Super duplex delivers excellent resistance to high chloride levels found in the oil field, such as formation water, and is particularly well suited for measuring production fluids and medium pipeline pressure applications.

Because of the corrosive compounds in crude oil, natural gas, and other hydrocarbon streams, more reliable and robust meters are required that can deliver highly accurate measurement over wide flow ranges.

The new coriolis meter offers  $\pm 0.10$  per cent mass and volume flow accuracy for liquids and mass accuracy of  $\pm 0.35$  per cent for gas. It can handle a maximum liquid flow capacity of 2550t/h.

Emerson's Micro Motion coriolis meters

are designed with no moving parts so they are not subject to wear or measurement drift associated with the rotating components of positive displacement or turbine meters.

In addition, Micro Motion smart meter verification delivers measurement confidence by verifying the complete meter performance (sensor, drive and signal processing) while the operation is flowing and without removing the meter from the line. Smart meter verification can check meter performance on a set schedule or at the touch of a button in minutes.

## Non-invasive

Usually, refinery plants use orifice flowmeters because of the high temperatures involved. However, tests at BP's Emsland refinery demonstrated that non-invasive ultrasonic technology would be a suitable method to measure the overflash volume conveyed in a 150mm pipe outside the distillation column.

As a result, the company turned to a WaveInjector from Flexim. This uses the transit time difference principle to measure flow volume.

Flexim's WaveInjector extends the possible application range of non-invasive ultrasonic measurements to temperatures up to 400°C. The system consists of two coupling plates, each connecting a transducer with the pipe, yet keeping both of them a certain distance apart. The surface of these plates radiates enough heat to keep the temperature at the mounting point of the transducers within the permissible range. Simultaneously, the coupling plates ensure the acoustical contact between pipe and transducer. The mechanically robust mounting fixture maintains a high contact pressure and specially designed metal foils eliminate coupling gel and ensure optimal contact and long-term stability.

## Explosive atmospheres

As the WaveInjector is a purely mechanical arrangement, it can also be used in explosive atmospheres, together with transducers that have been tested and certified for explosion protection. It is not necessary to cut into any pipes to install the transducers; they can be retrofitted without downtime or complicated approval procedures.

The optimisation of systems and processes at the refinery is becoming increasingly important, with

Fig. 1. The Micro Motion ELITE coriolis meter is designed for corrosive applications and harsh environments.



software for advanced control implemented for this purpose. It varies the process parameters based on mathematical models and data from the process control system and optimises the process using iterative learning control.

An important process value for this purpose is provided by the high-temperature ultrasonic measurement at the overflash return line. As reliable data is now available on the quantities that return as a function of the various types of crude oil and of the way the column is being run, the process can be optimised for energy efficiency and yield.

### Tracking losses

Recently RS Hydro was employed by an oil refinery to try and establish water usage across the site and to find out where substantial losses were being made.

To do this successfully, water usage needed to be monitored for a three-day period for 24 hours a day. RS Hydro decided to use the Panametrics PT878 to carry out the tests at 12 locations. Its engineers were able to install the meters within one and a half days, without the need for any pipe modifications.

As the PT878 has a battery life of 8-11 hours, and there was no access to mains power on the site, the PT878s were connected to car batteries to allow the 36 hours of continuous monitoring.

Site conditions including pipe materials and noise meant the locations were not ideal, but single traverse installations made the monitoring possible.

The meters were each set up to record flow rates and total flows over the three days. Diagnostic results at each meter installation were recorded to prove that the meters were running accurately.

The meters were uninstalled three days later. The recorded data was downloaded and sent to the customer in excel format allowing the refinery to create a valid water balance for the site.

RS Hydro offers an extensive range of flow meters which it says covers all applications and all industries.

For example, its ultrasonic flowmeters can be used on fluids with up to 5 per cent solids. The company supplies portable ultrasonic flow meters which can be used at multiple sites, permanent ultrasonic flowmeters which are designed to be used at a fixed location and hazardous area ultrasonic

flowmeters which are intrinsically safe for use in environments where equipment needs to be explosion proof.

In addition, recent advances in gas flow measurement technology have meant that it is now possible to measure almost all gases using clamp-on ultrasonic gas flow meters. These include natural gas, steam, compressed air, hydrogen, fuel gases, corrosive gases and erosive gases.

The transducers used in this kind of flowmeter are ten times more powerful than those used in traditional ultrasonic flow meters and produce clean, coded signals with very little background noise.

Then there are temporary or permanently installed insertion flowmeters which can provide a flow monitoring solution that is more economical than using a full bore meter - particularly in large diameter pipes. They are also useful as a portable survey tool where occasional measurement is needed at many points. Insertion and removal can be carried out without supply disruption, by fitting gate valves at tapping points.

The company also supplies a wide range of both full bore turbine flow meters, single jet flow meters and multi-jet water flow meters.

Full bore turbine flow meters use an impeller which is made of self-cleaning synthetic resin and rotates on stainless steel spindles mounted in the measuring chamber. For small pipe sizes (typically 5/8-in to 2-in diameter) multi-jet water meters are extremely accurate. These contain an impeller that is rotated by jets of water from multiple inlet ports.

Finally, AMS Instrumentation and Calibration has introduced the Katronic KATflow 200 clamp-on ultrasonic flow meter range, which utilises the transit-time method that is based on the principle of sound waves travelling with the flow will move faster than those travelling against.

The KATflow 200 series are hand-held ultrasonic flow meters suited for non-invasive and non-intrusive flow measurement of liquids and liquefied gases in fully filled pipes. The flow meters are equipped with one measurement channel to monitor the flow in one single pipe at a time.

The new flow meters come supplied with an internal datalogger and software for recording and downloading of measured values. They can also be equipped with an integrated wall thickness gauge to provide further information about the application parameters. ■

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