

Thought Leaders

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Flow Measurement of 'Difficult Fluids'

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Leading materials technology web portal – Azom.com interviewed Trevor Foster. Trevor's answers to AZOMaterials editor, Adam King's questions draw upon over 40 years of using innovative design and production techniques to produce elegant flow metering solutions for organisations around the globe.

AZO: Can you briefly describe Titan Enterprises, the kinds of products you sell, and which markets you sit within?

Titan: Titan Enterprises was formed in 1981 with the objective of producing high quality, lower flow flowmeters for OEM applications, preferably non-invasive but that was some time coming. There was a conscious decision not to compete with the \$1 coffee machine flow devices or the "big boys" who have vast marketing machines and high flowmeter prices to suit. Our core target market is still manufacturers who require a reliable flowmeter to integrate into their product in modest volumes at affordable prices. We do also sell one off devices through our factory in Dorset, UK and maintain a worldwide sales network. Drawing upon our engineering and manufacturing expertise we have also chosen to provide specialist flowmeters that other suppliers would not or could not manage. Over the years we have designed some outstanding custom flowmeters including the cooling system flowmeters in the nose-cone of Harrier jump jets, a diesel flowmeter with a low pressure drop and wide flow range for the Virgin Atlantic Challenger II (the one that did not sink), high pressure (1000 Bar) very low flow meters for the offshore oil industry. Other notable specialist flowmeters we have produced under OEM contract include a flowmeter to monitor the cooling system in Chemotherapy skull caps which are used to reduce hair loss of the patients and intelligent beer flowmeters that are used in outlets worldwide. Our customer base is worldwide with everything from military or precision laboratory products through to heavy duty meters for rock crushing machines.

AZO: What is the basic theory behind ultrasonic flowmeters?

Titan: There are two basic types of ultrasonic flow devices, Doppler shift or the more favoured "Time of flight" (ToF). Titan developed ToF ultrasonic flowmeter technology as it gives a more accurate and reliable results over a much wider range of liquids. Doppler shift ultrasonic

flowmeters use reflected signals from irregularities in the fluid which will be returned back at a different frequency than the transmitted signal due to the movement of the irregularity within the liquid. This is the same as the noise of a car approaching and then receding, the pitch of its noise changes as it passes with the approaching sound being compressed slightly and the receding being extended. With ToF technology the ultrasonic signals are transmitted both with and against the fluid flow. The sound travelling with the liquid arrives sooner than the sound travelling against the motion. The time difference between these two signals is effectively twice the fluid velocity. For our ultrasonic flowmeters we have engineered housing so we know the diameter of the tube hence which enables us to calculate the volumetric flow from the fluid velocity. For clamp-on devices this is not the case so the tube characteristics have to be determined prior to calculating the flow results. The smaller the tube diameter the harder it is to get a reliable, accurate result, this is exactly the area we specialise and have become a market leader in.



AZO: Why are corrosive fluids difficult to meter with most flowmeters?

Titan: Corrosive chemicals such as concentrated acids, bases and oxidising agents typically react aggressively with most metals, some plastics and some elastomeric materials and wipe out most flowmeter types at a stroke. For example, an electromagnetic flow meter, most of which have exposed electrodes, would have to be lined with a suitable material, usually an inert polymer, and have electrodes made from tantalum or titanium as these are resistant to a lot of aggressive chemicals. Positive displacement flowmeters usually have metal parts which would corrode although we have produced totally non-metallic oval gear flowmeters for a range of chemically challenging applications. Turbine flowmeters have a similar problem although there are some small all PVDF devices and many years ago we did develop a large PVC bodied meter with a double ended bearing-less turbine manufactured in glass filled PVDF. However, these devices tend to be specific to this chemical or type of chemical.

AZO: What are advantages of your MetraFlow Ultrasonic Flowmeter design and how do they help metering of caustic / corrosive fluids?

Titan: Our Metraflow design is based upon a simple, inert Fluorinated Ethylene Propylene (FEP) tube. We pass ultrasound through the pipe wall directly into the fluid and then receive the signal also through the tube wall. The only wetted material in our Metraflow is the inert pipe so there are no chemical compatibility issues even with corrosive and caustic fluids. Using a simple tube eliminates the inherent problems that can arise from using a specially moulded body with offsets and “dead areas” where the fluid, or debris can accumulate. An additional advantage of the Metraflow design is that there is no distortion to liquid flow path and the pressure drop is that of a piece of tubing. Unlike most other flowmeter designs there are no seals inside the Metraflow which may be degraded over time by caustic or corrosive fluids and the customer has full control of the choice of pipe and fittings to suite their application.



AZO: Can you give a specific example of the Metraflow being used to measure the flow of a caustic or corrosive fluid?

Titan: Recently the Metraflow was selected by a leading water treatment company that wished to accurately measure chemical disinfection dosing using sodium hypochlorite. Sodium hypochlorite (NaOCl) is a highly corrosive liquid commonly used as an oxidizing and bleaching agent and as a disinfectant. These properties challenge component parts used in most flowmeters. Our customer chose the Metraflow because its clean bore design is based upon a chemically resistant tube onto which are mounted high sensitivity ultrasonic sensors. The excellent chemical stability of the single flow tube design, coupled with the lack of any connections or seals within the flowmeter itself, has enabled prolonged accurate flow measurement of the corrosive sodium hypochlorite containing solution.

AZO: What other industrial applications could benefit from a device better able to reliably meter the flow of corrosive fluids?

Titan: We have found that the clean bore design and chemically inert construction of the Metraflow flowmeter makes it ideal for applications including drug pilot plant manufacturing,

laboratory work with concentrated acids and bases as well as notably in the electronics industry – monitoring silicon chip production. Even for less corrosive liquids the overall performance puts the Metraflow in the lead group to choose for low flow measurement applications.

AZO: What are the additional advantages of the MetraFlow Ultrasonic Flowmeter?

Titan: This product is not just for metering the flow of aggressive chemicals. Benefiting from its simple inert flow tube design the [Metraflow](#) is also perfect for metering the flow of ultra-pure products without risking contamination. The Metraflow is fully configurable offering you the flexibility to select a flowmeter configuration with resolution and outputs to optimally suit your requirements. For extra critical applications where the temperature of the fluid is closely controlled there is an extra “nulling” feature which allows the Metraflow to be used at even lower flows accurately by removing all the background noise from the signal.

AZO: Where can our readers find out more about Titan Enterprises?

Titan: As a company dedicated to excellent customer support we provide a wealth of technical, applications and service based information through our website – www.flowmeters.co.uk. In addition, we produced an informative quarterly customer newsletter (fLowdown) which is well worth signing up to receive.

