titan flowdown

...an informative bulletin from Titan Enterprises - the *low flow experts*

Welcome to the **September 2015** issue of fLowdown - a quarterly Newsletter from Titan Enterprises Ltd. written to keep you informed about the latest technological developments, applications advances and breaking news in the field of flow measurement.

If a particular feature interests you do not hesitate to contact us or follow the link for further information. We welcome your feedback.

Trevor Forster *(Managing Director)*

Trevor's Technical Tip

Trevor Forster is Managing Director of Titan Enterpises. His experience in fluid handling dates back to the mid 1960's when he started working on rotating seals and flowmeter design for third party clients. Drawing upon over 40 years of using innovative design and production techniques to produce elegant flow metering solutions for organisations around the globe, in this feature - Trevor offers you a useful technical tip.

10 Common Mistakes When Specifying a Flowmeter

In a recent discussion on Linkedin someone asked if the future of flowmeter sales was through online marketing? There was a great outpouring from industry professionals explaining why this approach could miss the benefit of interactive communication with an 'informed user' to ensure an optimium flowmeter solution is provided. It made me think of some common errors made when people set about specifying a flowmeter.

1. Flow rate: In some circumstances users have no idea what the flow rate is in their process pipe. "That is why we want to measure it". Plant construction is often such that for mechanical reasons much larger pipes are used than merely the size required to carry the flow. It is then that we have to start looking at the motive force behind the flow and the plumbing considerations. Often a user will overlook/forget that that their process is subject to significant pulsations and peak flow is perhaps forty percent higher or even twice the average.
2. Temperature: some users do not read their meters maximum operating temperature specification and assume that all flowmeters will operate to 150°C. When the meter fails it is somehow the products fault ! In a similar way to mobile phone manufacturers who put water evident markers in their phones we now include non-reversible high temperature markers in our meters to record if the maximum operating temperature has been exceeded for any length of time.
3. Viscosity: many users are unaware that a lot of flowmeters are viscosity sensitive and will significantly change their calibration with changes in the fluid properties. These Reynolds number sensitive devices are usually only linear in the "turbulent" flow range and their performance drops off as the fluid runs "smoother". For instance using a 40 cSt oil would immediately take a turbine meter, rated and calibrated for 1cst, out of the turbulent zone and into the non-linear laminar flow region. Changes in temperature would then change the viscosity and the calibration factor. Many flowmeter types rely on higher Reynolds numbers for their linear performance including vortex shedding, Pelton wheel, variable area and most pressure differential devices. Other technologies such as positive displacement, Coriolis and ultrasonic meters are less sensitive to these changes but not completely immune.
4. Output type: "Will the flowmeter interface with my instrument?" We don't know, what are the input requirements of your instrument? Logic level, NPN or PNP pulse, analogue current or voltage or a higher level language? Please check this requirement before specifying the meter !
5. Pipe connections: your chosen pipe connection should be dictated by your process flow rate. A meter to work at 100ml per minute is not likely to have a 1" NPT pipe thread. Typically a small flow meter will have small pipe connections. Specifying the correct thread of flange detail is essential, do not just specify the line size alone.
6. Pressure drop: This is a very important consideration. Will the available pressure head be enough to operate the flowmeter you have chosen efficiently and still leave enough available for later processes? This is often overlooked with resulting commissioning delays as either an alternative product or more pumping capacity is required.
7. Pulsating flow: As already mentioned pulsating flow can cause problems for most flowmeter types. Positive displacement devices are undoubtedly the most immune with all other flowmeter types sharing the honours on intolerance. It is always best practice to eliminate pulsation with a damper and a pressure regulator. It can be a simple air pocket and a length of flexible tube or a commercial bladder damper with appropriate gas charge and a high quality pressure regulator. Either method will reduce the pulsations but only within a limited set of operational parameters. Change the stroke, frequency or flow rate of the pump and the efficiency of the damper will be reduced.
8. Environment: Is your flowmeter outside in an Alaskan winter or subject to the Saharan summer? Is it in a hazardous area on an offshore oil rig? We have had users forget to mention all of the preceding scenarios. Environment specification is especially important for hazardous areas where the flowmeter will require an appropriate meter and detector.

Trevor's Technical Tip continued

9. Power supply requirements: All flowmeter manufacturers try to immunise their products from poor power supplies. Most experienced users will specify a quality power supply for the sensors around their plant. Some will then add solenoids, dc motors and other noisy electrical apparatus and wonder why their flowmeter electronics are having problems. If you have an analogue output you will require a suitable voltage supply, it will not work off 9V.

10. Installation constraints: "I did not realise I needed straight pipes before and after the flowmeter!" Before specifying check out your flowmeters installation instructions as well as the meter specifications. If you have a tight operating space, consider a positive displacement meter which will be largely immune from the surrounding plumbing. Will you require a filter? It is good practice to install a filter close to the flowmeter but very few users do as they rely on other parts of the system. Will your fittings affect the flow profile onto the flowmeter?

Which brings me back to the original driving force for writing this feature. Before choosing a meter always read the whole specification sheet and installation instructions for the flowmeter you are considering. If in doubt talk to your supplier who will be able you to help you specify the optimal flowmeter for your process.

Flow Technology Spotlight

In each issue of fLowdown we review a particular flow metering technique, its benefits, shortfalls and the applications to which it is best suited. In this issue we look at Differential Pressure Meters.

Overcoming the challenges of implementing flow technology in a medical application

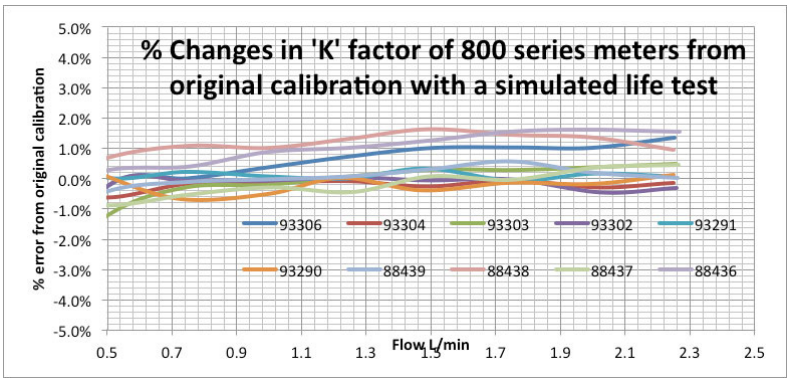
By Trevor Forster

Medical facilities have many applications where precise measurement and control of flow is important. The strong appeal of establishing volume flowmeter sales installed in OEM medical equipment is obvious but the route to becoming the "specified flowmeter component" in this heavily regulated industry is often long and arduous. As an established OEM flowmeter supplier to this market – we share with you some of the key challenges that have to be typically overcome to successfully implement flow technology in a medical application.

Reliability: In many medical scenario's a first challenge to overcome is to demonstrate long term reliability and performance. Proving that your meters have a multi-year life cycle with no significant degradation in performance is demanding. One recent medical application required a 4 year life cycle so the customer purchased ten of the meters and subjected them to an accelerated life test. They then returned the meters to Titan for calibration comparisons. Five of the meters had not changed in performance significantly, two had shifted slightly. The other three had changed calibration by between 0.5 and 1.5% well within the customer specified requirements for their medical products lifetime. The customer then informed us that they had only subjected half the meters to the test and retained the other 5 unused as a reference.

This is typical of the caution medical equipment manufacturers exercise and demonstrates the due diligence taken by the engineers specifying for these applications. The product must be dependable even with these relatively low cost flowmeter components where the specified accuracy is only ±1.5% of full scale.

Customisation: once performance and reliability is demonstrated – manufacturers often ask for a custom version of the flowmeter optimised to fit their medical device. In the above example – Titan invested in a new tool specifically for this customer to produce a meter with the same hose fitting connection they were using throughout their device. Simplifying the production process through this tooling investment reduced the long term assembly costs, important in a competitive marketplace where thousands of units are purchased each year. To make the wiring simple as well the meter has a precise cable length with a customer specified electrical socket.



Sterile applications: We have licensed our Atrato® ultrasonic flowmeter technology for one high volume medical application where the sensors are used for bolus (injection) measurement and therefore have to be manufactured in clean rooms and sealed in sterilised packaging. We do not have these facilities so licensing was a pragmatic solution which suited both parties. We are currently working on low flow clamp-on systems so that our meters can be used external to fluids in contact with the body and therefore not require the same level of sterilisation.

Electrical integrity: Any piece of medical equipment has to withstand electrical interference without compromising the function of the unit. Flowmeter sensors must have excellent noise immunity so no false readings are made.

To discuss your medical flow metering application with Titan Enterprises please contact dee@flowmeters.co.uk or telephone +44-1935-812790.

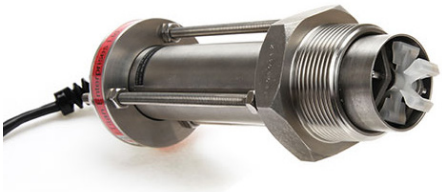
Product Updates

Compact High Pressure Flowmeters

Based upon its proprietary oval gear design – Titan's OG-1 and OG-2 flowmeters are designed to give reliable, high performance in high pressure applications. Constructed from durable materials including 316 Stainless Steel and PEEK™ - these compact meters are perfect for measuring flow at pressures up to 700 Barr and 150°C. Designed to be IP-67 / NEMA 4 compliant, Titan OG-1 and OG-2 high pressure flowmeters are available in standard and customer specified configurations. Please visit http://www.flowmeters.co.uk/pd_og1.php

Insertion Turbine Flowmeters

The Polyvinylidene Fluoride (PVDF) turbine on Titan insertion turbine flowmeters rotates freely on a 316 stainless steel shaft and has specially aerofoil shaped blades to extend the dynamic range of the meter. The specially contoured housing further improves the meters linearity particularly at lower fluid velocities. Each meter contains two sensors, one self-powered (for battery operated equipment) and the other an open collector transistor. A reed switch may be specified for hazardous areas were simple apparatus is acceptable. The body is manufactured from AISI316 stainless steel and as standard is supplied with three metres of five core screened instrument cable. These insertion turbines provide a cost effective and simple means to measure the flow of a wide range of low viscosity liquids.



How do I measure?

How Titan determine flowmeter repeatability

Flowmeter performance critically depends on repeatability. Without a repeatable sensor you cannot have good performance. The reference that your flowmeter is calibrated against must also have excellent repeatability. The Titan Enterprises flowmeter test rigs are based upon piston provers. These are similar to hydraulic rams with a linear encoder on the piston. Air is used to push the piston and the fluid is displaced through the flowmeter back to the storage tank. The number of counts on the encoder for a given volume of fluid represents the repeatability of the rig.

In the calibration certificate the repeatability of the water draw mass and the scales together is ±0.03204453%. The manufacturer specifies the rig repeatability at ±0.05%. This is therefore the primary uncertainty for all other repeatability runs.

A flowmeter repeatability cannot be recoded any better than this even if it is perfect. For a production flowmeter calibration we set the flow rig to only accept successive results which agree within ±0.1%. If the reading is not accepted the meter is rejected and rebuilt.

Below is a series of results showing runs to check repeatability over a number of points and demonstrating the importance of number of pulses taken.

At 500 pulses we are approaching the achievable repeatability of the flow rig. The flow rate varies a little from 0.596 to 0.604 Litres per minute but as we are recording pulses per litre this is a second order affect on a linear sensor.

This example was from an Atrato® ultrasonic sensor with a sample time of around 25 ms so trying to measure just 6 pulses will give poor repeatability as each successive measurement is likely to be slightly different.

Flow rig calibration certificate

Model	Microtrak Model MT50	Calibration date :-	XX/XX/XXXX
Serial No	MT94040139	Calibration due :-	XX/XX/XXXX
Room temp	20		

Run Number	Translator pulses	Liquid temperature	Translator temperature	Draw pressure	Weight (Grams)	Corrected weight
1	1499	21.543	20	100	546.05	545.03
2	1500	21.631	20	100	546.10	545.08
3	1500	21.638	20	100	546.20	545.18
4	1501	21.638	20	100	546.15	545.13
5	1500	21.648	20	100	546.00	544.98
6	1499	21.649	20	100	546.05	545.03
7	1500	21.641	20	100	546.10	545.08
8	1501	21.645	20	100	546.25	545.23
9	1500	21.713	20	100	545.95	544.93
10	1502	21.652	20	100	546.30	545.28
Average	1500.2	21.6398	20	100	546.12	545.09

Water density @ temp	0.9985309	Weight max	546.30	545.28
Water volume	546.92	weight min	545.95	544.93
		Error ±%	0.03204453	

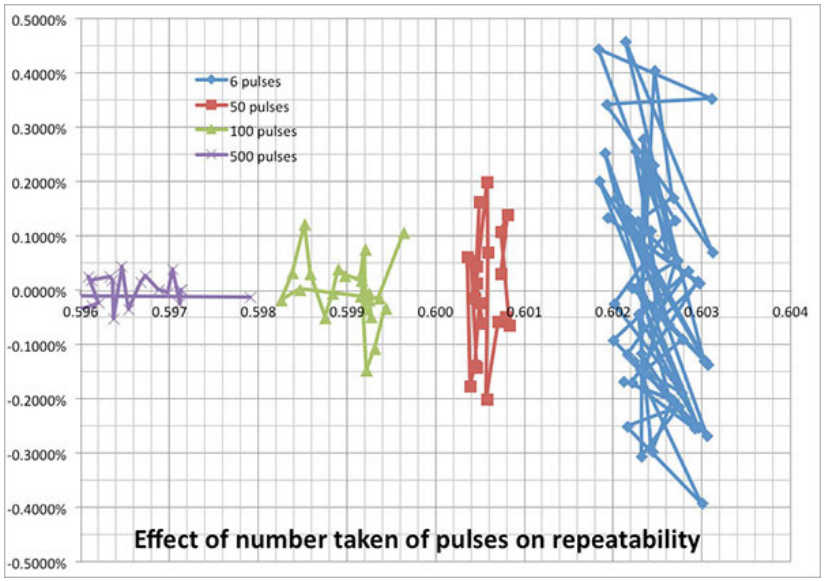
Correction for compressibility	1.000115
Correction for thermal expansion of tube	0.9999542
Correction for thermal expansion of translator	0.999983
Correction for expansion of tube for pressure	1.000052
Rig calibration constant	2747.3267 Pulses/litre

Scales used:-	Worldweigh OHC3		
Serial number :-	810563003		
Recalibration due :-	XX/XX/XXXX		
Calibrated by	J Thorne	Date	XX/XX/XXXX

File :-MT50-rig-cal-Jun12.xls

A typical flow rig calibration certificate

How do I measure? continued



For further information regarding how Titan Enterprises determines flowmeter repeatability please click here.

Humour

Some funny phone calls received by Titan:

"Do you make crystal balls?"

"I've been in the hydraulic industry for 20 years, what is viscosity?"

Salesperson calling Titan: Aggressive tone "I spoke to your MD just yesterday!" Passive response "that's strange as he is on a holiday with no telephone".

Bulletin Board

To enable you to make informed decisions about the flow metering challenges facing your organisation this newsletter feature keeps you up-to-date on the latest literature, hints and tips, initiatives and company news from Titan Enterprises.

Titan Enterprises are recruiting !

Hands-on Engineering Manager.

Titan Enterprises is looking for a new key member of staff. The successful candidate will be responsible for all aspects of engineering within the company, manufacturing / troubleshooting of our product range, ongoing R&D, technical sales support and initiating product developments to meet new market requirements. Ultrasonic and flowmeter experience are highly desirable along with leadership and motivation skills for our small enthusiastic workforce.

In the first instance please send Trevor Forster (trevor@flowmeters.co.uk) your C.V and reasons why you would like to work at Titan Enterprises.

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