

## **The Development and Performance of a Low Uncertainty Flexible Multi-Viscosity Calibration Facility**

**By**

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It is becoming increasingly clear that good flow measurement of hydrocarbons needs good quality calibration. It is now accepted that most meters, USMs and Coriolis included, have a calibration curve controlled by Reynolds number, and even for good in-situ proving they need to be linearized, or have a data fit to give them a satisfactory performance. This is also true of the old and trusted concept of differential pressure meters, especially the newer wedge and cone type meters with their claims for good low Reynolds number performance. There are very few facilities throughout the world to calibrate such meters and confirm their performance.

This paper describes the development and performance of a low uncertainty multi-viscosity hydrocarbon calibration facility. The particular features that give the facility a special enhancement are the attention to control of temperature, so important for calibrating Reynolds number based meters, a standard system for calibrating custody transfer meters with pulse outputs, but with the additional enhancement of the ability to collect data direct from analogue, differential pressure and serial output meters during calibration runs. This enables the facility to simply calibrate any device, including even strainers, pumps as well as flow meters. To ensure the quality of the measurement multiple systems are available, allowing internal confirmation of the facility performance. There are two provers that can be locked in series to check each other by using the Helical turbine master meters in series, in line with API MPMS 4.9.

The facility is ISO 17025 accredited for measurement uncertainties of 0.024% when using direct proving and better than 0.05% for master meter calibration. The paper also shows a number of calibrations of different meter types to show the flexibility and performance. The calibrations of the master meters shows data over a 3000:1 Reynolds number turndown. While this has been seen before this is data for three identical meters, and contains a very high quantity of data confirming the overall performance of this type of meter as a master meter.