Abstract

Making the multiphase flow meter less dependent on dated PVT

Measuring the properties of the individual fluid phases in a multiphase flowline at pressure and temperature

“A MPFM [multiphase flow meter], like any other type of measurement instrument, needs certain input to operate. Making sure that the basic input is accurate and up-to-date is one of the biggest challenges in operating multiphase meters.” *[1]

“The main issues with multi-phase measurement are the multiple and varied fluid properties and flow regime present at the point of measurement…Recent blind tests suggest that measuring fluid properties instead of PVT calculated properties provided improved certainty.” *[2]

At Proserv, we sampled into a pressure compensated (at ambient temperature) sampling system that could quantify the volume of each individual phase taken from a multiphase flowline, which enabled the trapping of each phase for further analysis. This was a compositionally representative sample.

The individual phases could then be used to measure density and permittivity, and the data used as a live validated user input to the MPFM for calibration.

Sample point, and other flow regimes, impacted on the quantity of individual phases captured, and without qualification of the exact volumes, it would not be possible to sub-sample in the confidence that the right compositionally representative sample was being taken.

Removing the requirement to send samples onshore which contributes to an increased carbon footprint and a further time delay, due to onshore analysis and modelling being carried out, only stands to enhance meter performance, and mitigates the need to retrospectively apply the data generated to the performance of the MPFM at the time the sample was taken – which can introduce uncertainty and mismeasurement errors.

System performance testing was carried out at the TÜV SÜD National Engineering Laboratory in Glasgow, where numerous samples demonstrated that under the right flowing parameters and sample point set-up, a multiphase sample could be taken at line pressure and individual phase volumes could be accurately measured. This patent pending system is a new innovative product currently in final stages of development and is planned to be available to the industry by the end of 2022. We would welcome the opportunity to explore the gains to be had and examine how it could potentially enhance the industry more widely.

*[1] https://nfogm.no/wp-content/uploads/2014/02/Calibration-and-Maintenance-of-MPFM.pdf

*[2] http://www.jmcampbell.com/tip-of-the-month/2018/03/multiphase-flow-measurement-what-is-it/

Fluids used

- Gas – Nitrogen
- Oil – Mineral oil
- Water – Fresh Water

Flow-Loop & Sample System Parameters

- Vertical pipework orientation
- Gas velocity at 11 m/s
- Liquid velocity at 4 m/s
- System pressure 60 bar
- Oil volume fraction 10%
- Water volume fraction 10%
- Gas volume fraction of 80%
- Sample system volume 1.9 Litre

Reading of GWR on completion of sampling, once system filled

Level (7)	Inter (8)	Level linearised	Inter Line	Thickness	Distance
274.7mm	124.0mm	1.015 Litre	0.485 Litre	0.530 Litre	289.333mm

Phase	GWR Reading	Drained Volume
Water	0.485 Litre	0.500 Litre
Oil	0.530 Litre	0.530 Litre
Total	1.015 Litre	1.030 Litre

Result: Total error of 0.015 Litre - from water measurement

Conclusion: Accurate determination of individual phase volumes captured from a multiphase flowline allows for sub-samples to be taken for on-site analysis, removing the requirement for sending onshore and modelling to be conducted.