

Case Study: Pipeline Metering with DRA injected oil products

8 Inch BiRotor Plus Meter

When facing problems with measuring DRA injected oil products in their pipelines with conventional and helical turbines, a major pipeline and terminal operator, based in the U.S., turned to Brodie for a solution. This led to a trial installation of the brand new 8" BiRotor Plus PD meter.

The results of this trial and evaluation exceeded the pipeline operating company's expectations.



The challenge

As demand for transported finished hydrocarbon product grew, pipeline operators found themselves restricted by the flow capacity of their 8-inch conduit line used to supply bulk terminals in varying locations in the U.S.

The operator decided to use a drag reducing agent [DRA] to help increase the pipeline throughput to meet downstream demands and subsequently invested in a series of modular injection skids, strategically positioned along this transport corridor.

A water based polymer was selected with anticipated benefits to include increased pipeline flow capacity and optimized operational efficiency by reducing line pressure.

While this injection project achieved its goal of increased throughput, an adverse effect was experienced on the system mass balance performance.

The incumbent metering systems included standard turbine meters with flow condition units installed both upstream and downstream. These meters were calibrated daily using both bi-directional and small volume provers.

As the saturation level of DRA increased, the performance of the turbine meters became more erratic.

Strategic approach

The pipeline company had installed a helical turbine meter on a trial basis to overcome the negative effects of DRA, achieving little success, so they reached out to Brodie International for advice and input.

Brodie was in the test phase of a new 8 inch BiRotor Plus meter (B311C), with a BETA test unit having recently completed successful testing for NMI at a flow laboratory in East Kilbride, UK.

These tests included measurement comparisons versus standards on varying liquids with viscosities ranging from 2cSt to 800 cSt.

The performance of this meter displayed a near linear accuracy curve regardless of test liquid viscosity.

Brodie felt that this new meter would be a good solution for the challenges experienced by the pipeline operator and supplied a unit for field trial and evaluation purposes.



Brodie's 8" BiRotor Plus PD meter in place of a helical turbine meter.

The spool pieces up and downstream of the meter are not required for the BiRotor Plus.

Evaluating the benefits

The B311C BETA meter was initially installed in a pipeline metering site which is subjected to a DRA saturation at a rate of 5 PPM.

This is generally the lowest rate of injection, but even at this dosing level, had a significant adverse effect on the linearity and repeatability of the turbine & helical meters, resulting in system performance drifting outside of the acceptable corporate tolerances.

The newly installed Brodie meter was proved several times per day to provide as much operational data as possible over a short time frame.

Immediate system balance benefits were visible with both linearity and repeatability of the meter falling comfortably within permissible tolerances.

After receiving positive results for the trial and evaluation exercise in the first location, Brodie received a request from the pipeline operator to relocate this meter to another location where the DRA saturation rate was higher.

Here, the DRA polymer was injected at 15PPM, which is the maximum allowed rate.

This dosing percentage resulted in the most erratic performance from the measurement system and was viewed as an ultimate test of the Brodie B311C durability to handle difficult and viscous products.

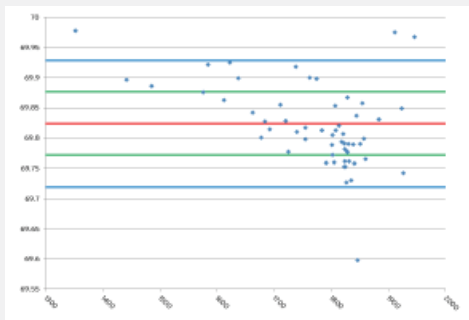
The meter was installed in the pipeline and proved several times per day using an in-line small volume prover, with the resulting proving data supporting the belief that the Bi-Rotor Plus meters are virtually unaffected by viscosity or changes in process gravity.

The successful trial and evaluation of this highly accurate PD meter has resulted in an overall system balance through the stations it was installed into, proving far superior to other meters they have previously selected for the pipeline operator's system.

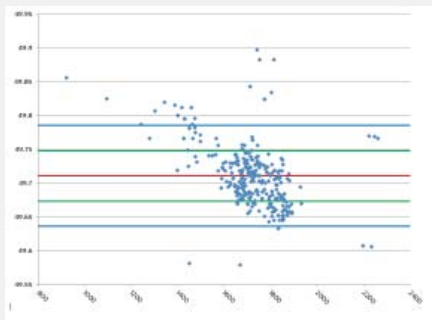
The linearity comparison below shows that the BiRotor Plus meter has the lowest cost of ownership, when accuracy of measurement is considered.

Linearity Comparison

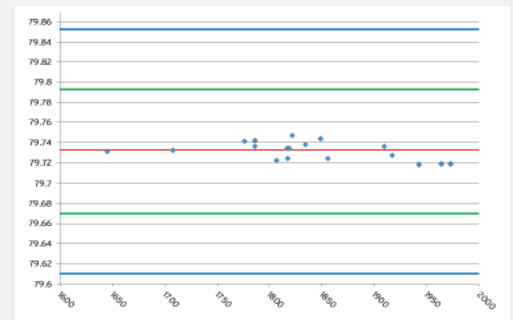
Helical Turbine



Turbine

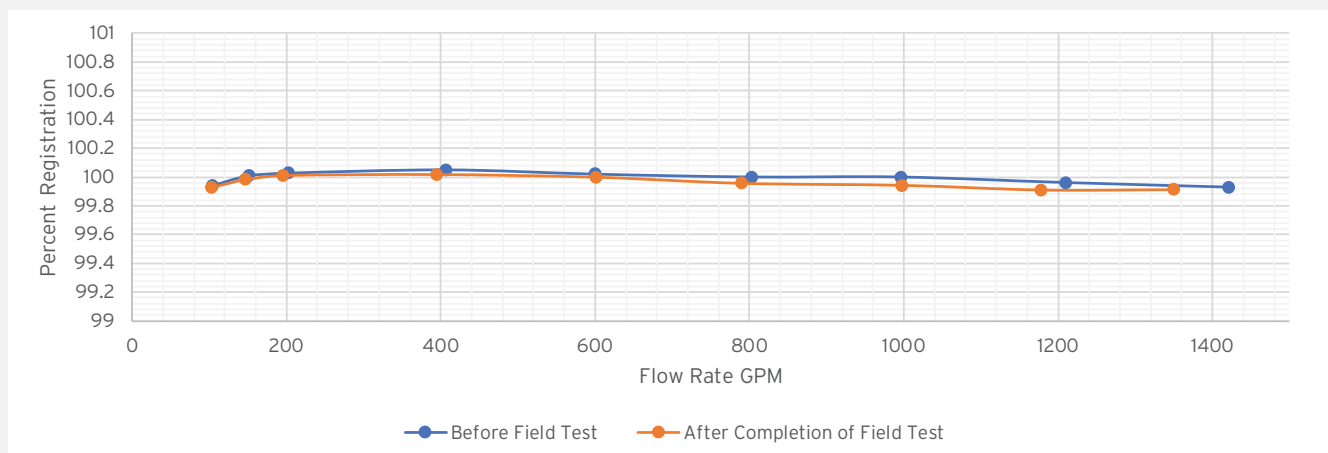


Brodie BiRotor Plus 8 Inch



Linearity between the blue lines: +/- 0.15%
between the green lines: +/- 0.075%

Linearity before and after 5.8 Million BBL field test [tested on 8" Ball Prover]



Customer Feedback

"Overall we were very pleased with the performance of the meter.

The Brodie 8" meter not only had great repeatability [which the other meters had as well] but the Brodie linearity was absolutely amazing. Amazing considering the high DRA concentration.

Please see the attached performance trends for the traditional turbine and the helical meter attached.

In comparison, the Brodie performance stands out.

To note, the turbine and helical performance data is ONLY from the Tennessee location, as this was the highest DRA concentration line. The turbine data is one year's worth of data, and the helical is for 2 months of testing.

Let me know if you have any questions. Thanks!"

[Terminal operator at Tennessee location]

Brodie 8 inch BiRotor Plus B311C

Flowrate (max) 3571 BPH (567 m³/Hr). Viscosity 1,000 cSt
Approvals: CSA, ATEX [pending], PED, MID & OIML

Universal Mounting Box [UMB]

Incorporating pre-amp and field terminations. Hazardous area compliant and fully weatherproof.

Double Case Design

The BiRotor Plus is immune to pressure and temperature changes. It complies to API MPMS Chapter 5.2.5.2.4.

The measurement chamber is in contact with the measured liquid both on the inside and the outside of the inner case.

Dual Non-wetted

Pickoffs

With toothed wheel pulse initialization for direct and instantaneous pulse output [no mechanical shaft].

Hardened Timing

Gears

The only metal to metal contact point in the meter, the timing gears are made of 17-4 PH heat treated Stainless Steel.

Ceramic Bearings

Hybrid ceramic bearings guarantee minimal wear and reduced maintenance.

Twin Helical Rotors

The heart of the BiRotor Plus, these rotors never contact each other nor the measurement chamber's surface. There is minimal friction or wear, even after decades of operation.



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