



## DIRECT MASS MEASUREMENT OF NATURAL GAS LIQUID (NGL) REDUCES CAPEX AND LOSSES DUE TO SOLUTION MIXING AND MEASUREMENT ERROR

### RESULTS

Reduced installed cost of \$18,000 compared to inferred mass measurement systems

Eliminated a need for flow conditioning and online density measurement

Reduced real estate cost with smaller overall asset footprint

Achieved improved accuracy for invoicing on each component in complex NGL mixed streams from a single flow meter measurement device



### Application

Measurement of NGL streams (while they are still a complex mixture of different light hydrocarbon liquids) is a critical application for a major midstream oil and gas company. The accuracy of the measurement affects their revenue and profit, and the installation CAPEX can be costly. To protect company profit and void inventory balance problems, they decided to apply mass flow measurement techniques to avoid all the errors and uncertainty that would otherwise result if they were to measure the NGL in volume units.

Mass is measured directly with a Micro Motion Coriolis meter. The customer also considered the option to measure inferred mass by measuring volume and density separately. Direct mass measurement was selected because it has several advantages over inferred mass measurement including a lower installed cost and better overall accuracy.



### Challenge

To deploy inferred mass measurement systems with volume flow meters, an additional online density measurement would have been required in a bypass loop (Figure 1.). Online density must be measured at the same process conditions as flow through the volumetric flow meter. Maintaining the same process conditions in both the volumetric flow meter and the density meter is difficult and costly under dynamic conditions, but if not done very carefully, these differences can result in unacceptable overall measurement error.

Additional cost, components, and design scrutiny would have been needed to ensure the density measured in the loop was held within an acceptable range of error in order to accurately convert the volume meter measurement in the main line to inferred mass. By choosing to measure mass directly with the Micro Motion Coriolis meter, they were able to completely avoid the need for the density loop and density meter.

1 Micro Motion white paper number WP-002037 provides details of direct and inferred mass measurement systems.

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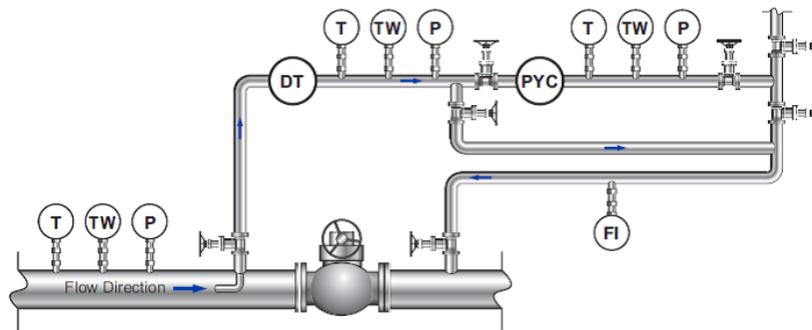


### Solution

One other concern was addressed by the selection of Coriolis meters for direct mass measurement. NGL fluids experience solution mixing which makes the measurement of either direct mass or inferred mass critical for accurate accounting. Solution mixing is an affect that causes the expansion and contraction of the mixed NGL stream to be completely unpredictable as a function of pressure and temperature. This makes traditional volume measurement of NGL unworkable and amplifies the error of an inferred mass system compared to a direct mass system. With an inferred mass measurement system, it is not good enough to just measure pressure and temperature at the density loop; you must actually control pressure and temperature to be the same as they are in the main line so that the density will be the same in both places because there is no way to do a density correction for any difference in conditions that might occur.

The customer used Micro Motion ELITE® Series flow meters to measure mass flow directly, which eliminated a need for online density measurement. The cost of the density meter and the bypass loop with all its components to control temperature and pressure conditions were eliminated by using a direct mass measurement in the main line.

Micro Motion Coriolis flow meters do not require flow conditioning and this provides additional installation cost savings over volumetric flow meter technologies.



- T = Temperature Measurement
- TW = Test Thermowell
- P = Pressure Measurement
- DT = Density Transmitter
- PYC = Pycnometer
- FI = Flow Indicator

Figure 1. Volume Meter System Design with Density Loop that was Eliminated Using Coriolis Direct Mass Flow Measurement

AN-002072