

North Sea Installation

Adapting to retrofit a Sure-Cut® water cut meter as a replacement unit on a mature North Sea asset

Challenge

In 2022, M-Flow installed two Sure-Cut® Lo water cut meters for a leading North Sea producer. These were direct replacements for outdated meters (from a different manufacturer) that over time had become less reliable, requiring regular manpower-intensive interventions to maintain calibration.

As a brownfield retrofit, there were significant constraints in the project. The Sure-Cut® Lo meter had to:

- Fit into the same pipework as the existing meters (flange face to face length and surrounding structures)
- Use the same 2 wire link to the instrument room used by the older 4-20 mA devices.
- Meet offshore North Sea material and coating specifications.

Project Execution and Advantages

The modular design of the Sure-Cut® Lo allowed M-Flow to build a system which exactly matched the face to face flange length of the older meter and the North Sea material specifications, without modifying the standard measurement section.

The small single enclosure electronics simplified overall installation and communications, and with a new flow computer, was completed using Modbus 485 on the existing twin wire loop.

Not only was this completed at half the capital cost of a direct replacement of the existing meter, but the Sure-Cut® Lo provides significant operational advantages:

- The digital electronics and composite construction give a robust system which is not susceptible to calibration drift, meaning a longer field life with limited (if any) recalibration.
- The Wi-Fi connectivity which allows all set up, diagnostics and full data history to be obtained via a hazardous area laptop

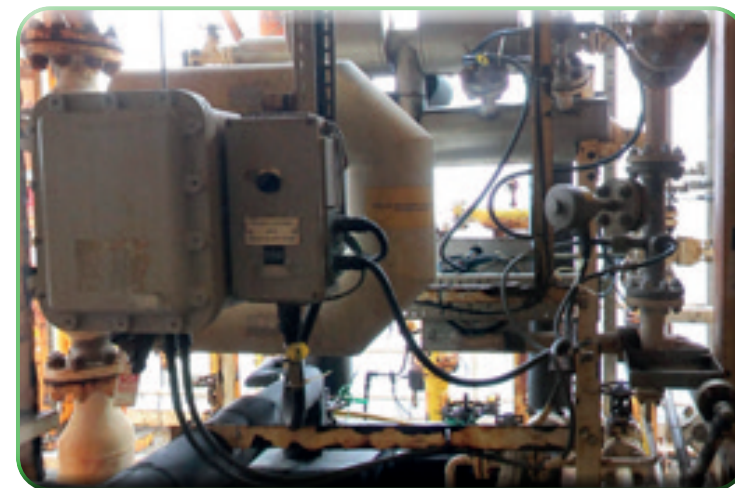


Fig. 1 - Existing meter prior to replacement

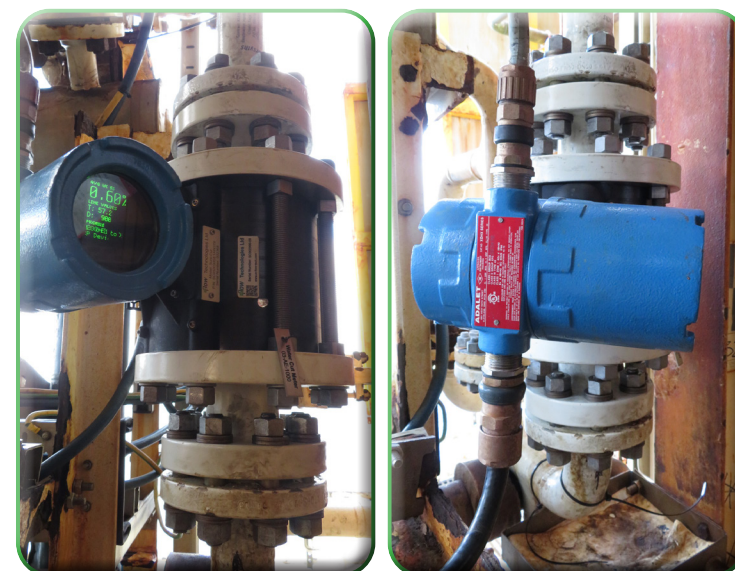
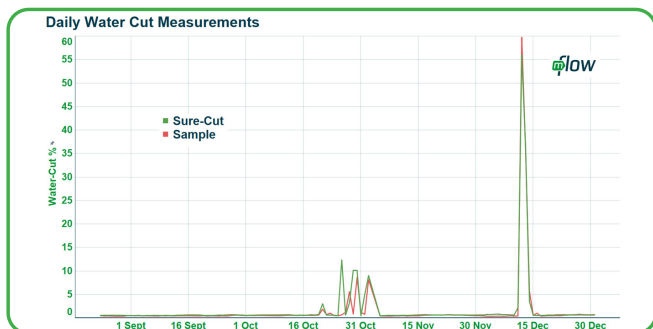


Fig. 2 - M-Flow Sure-Cut® Lo meter installed

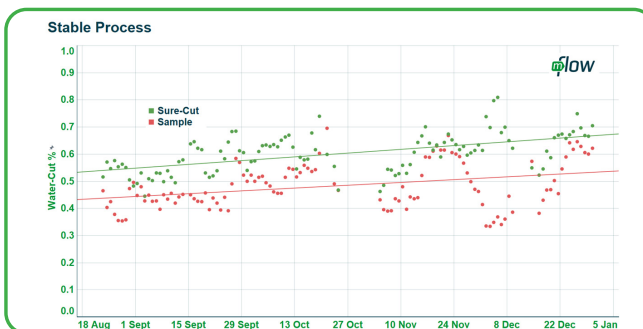
Field Data and Performance

To consider the performance of the continually running Sure-Cut® Lo installed on the transfer line to storage, the following analysis looks at daily comparisons over 4 months. A composite sampler was used to create a 24 hour sample and an experienced specialist carried out a Karl Fischer analysis. Additionally, the Coriolis line density for the sample time was also recorded.



In this graph, sample data (red) is compared to Sure-Cut data (green).

- For the majority of the almost 4 month period samples and Sure-Cut were below 1%.
- There were two periods during the 4 months when the data showed days of process upset leading to excess water entering storage.



Looking at the days where water cut was below 1%.

- The average daily difference between the Sure-Cut and samples was 0.1%.
- That is not an absolute measure of M-Flow uncertainty because it includes uncertainties in both methods.
- Looked at over the almost 4 month period, the same cyclical trends appear in both data sets and the Sure-Cut read consistently 0.1% higher than sampling.
- Both methods trended up by 0.1%, further confirming repeatability of calibration over a sustained period.

- Measurement differences between Sure-Cut and samples were occasionally more significant during these upset periods.
- Lab processes become more difficult at high water cut, so Coriolis density trends were also used to validate that Sure-Cut correctly measured the impact of water slugs.
- On the limited days when average water cut was over the inversion point, the majority of water cut values were accurately provided by the Boss-Cut functionality.
- As shown in the images below (taken 5 minutes apart), the Boss-Cut function was also key to determining water cut on the limited days where the average water cut was raised by intermittent slugs.



Conclusions

M-Flow's Sure-Cut Lo water cut meter provides accurate, repeatable data over a sustained period in oil transfer applications. Additionally, it provides data across the full 0-100% water cut range when process upsets occurs, which can be used to quantify water transfers and trigger upset alarms.