

FIELD TRIAL: CLAMP-ON WATER CUT & FLOW RATE RESULTS WITH GLOBAL TIER 1 OIL COMPANY

Results comparing XSENS clamp-on Water Cut & Flow Rate Meter against BS&W manual sampling and inline Turbine Meter flow measurement.



WATER CUT TESTING ON BULK CRUDE OIL LINE FROM OFFSHORE

Written by: Kenneth Olsvik, Tarjei Rommetveit, Yofri Yaşar

The Tier 1 client requested XSENS to test its patented clamp-on meter, which measures 0-100% water cut with +/-1% accuracy absolute and flow rate with +/-1% accuracy of actual flow. Measurement was conducted on three different pipelines, both onshore and offshore. The focus was on water cut measurement of the crude oil-water mixture.

For trial purposes, a portable XSENS unit (slightly lower accuracy) was used instead of the fixed, highest accuracy XSENS unit intended for permanent installation. XSENS successfully compared its results against the Client's reference turbine meters and manual BS&W sampling during a supervised trial in September 2025.

Reference data from the oil company was handed over to XSENS after XSENS delivered its measurement results to the oil company. This blind test demonstrated the technology's performance and versatility across different bulk lines.

WHAT'S INSIDE THIS ISSUE:

Comparative testing demonstrated that the XSENS clamp-on meter accurately measures water cut across multiple crude oil lines by utilizing sound speed analysis to detect fluid separation, validating results against traditional sampling methods.



WWW.XSENSFLOW.COM



The XSENS Portable Meter was installed on three different pipelines with sizes 18" and 10" (bulk) and 12" (crude to wash tank). Flow rates were compared against existing Turbine Flow Meters and water cut measurement was compared against manual BS&W sampling. Densities of the oil from the different pipes were 38, 41 and 28 API. Water cut varied from 0% to 60%. Flow velocity ranged from 0.4m/s to 1.2m/s.

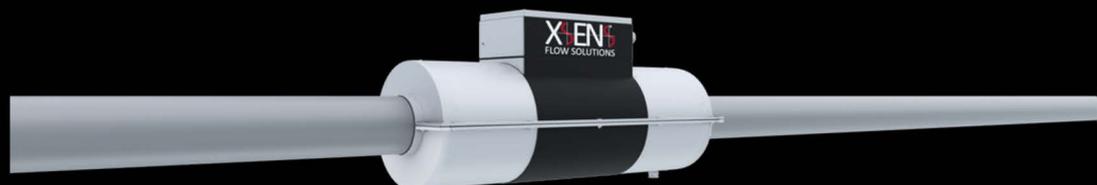
The XSENS meter calculates water cut based on measured Speed of Sound (SoS) of the water/oil mixture inside the pipe. Before start-up, XSENS measures Speed Of Sound (SoS) of pure oil as well as water-salinity, which is used as an input to the the water cut calculation. Temperature is measured by the XSENS Meter to update the water cut model with changing temperatures.



Figure 1: Onshore installation with portable kit showing transducers strapped to pipe, electronics pelican case, battery and PT100 temperature sensor.

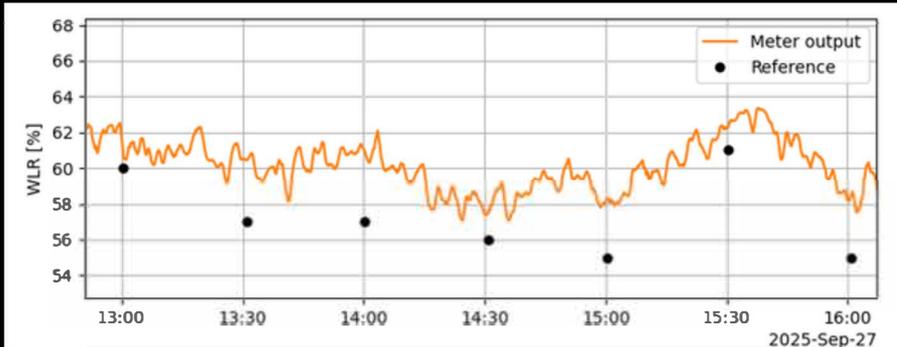


Figure 2: Offshore installation of portable kit with XSENS personnel and local partner support.



TEST MEASUREMENTS

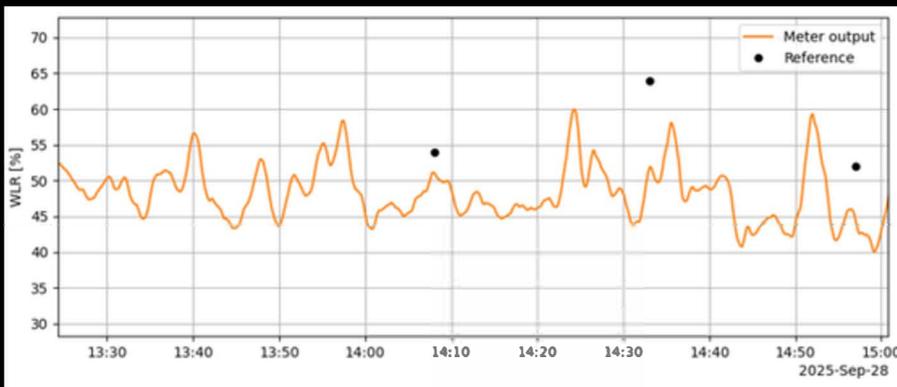
Below figures show Water Cut and Flow Rate results for the 18", 10" and 12" lines.



18" Water Cut measurements

Date sampled	Time sampled (Hrs)	BS&W (%)	XSENS WC (%)	Diff (%)
27 th September 2025	1300	60.00	60.5	0.5
	1330	57.00	60.5	3.5
	1400	57.00	61	4
	1430	56.00	57.5	1.5
	1500	55.00	58	3
	1530	61.00	62.2	1.2
1600	55.00	58.5	3.5	

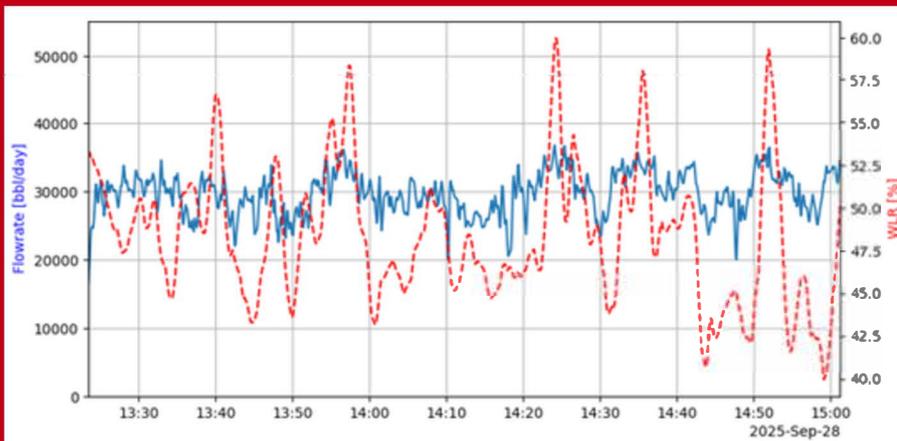
18" Manual BS&W Samples



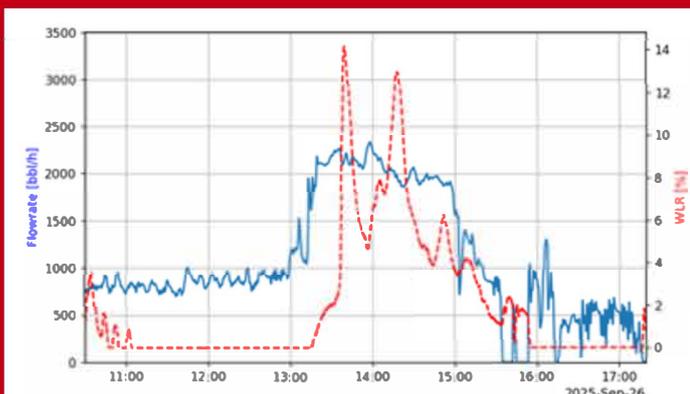
10" Water Cut measurements

AB ANALYSIS				
Date sampled	Time sampled (Hrs)	BS&W (%)	XSENS WC (%)	Diff (%)
28 th September 2025	1408	54.00	51.2	2.8
	1433	64.00	52.5	11.5
	1457	52.00	46	6

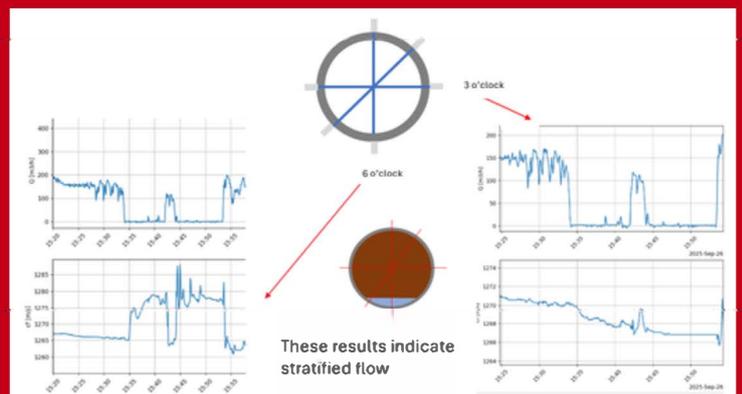
10" Manual BS&W Samples



10" Liquid Flow Rate and Water Cut measurements



12" Liquid Flow Rate and Water Cut measurements



12" Stratified Flow indication with XSENS measurement

TEST RESULTS - WATER CUT

As illustrated in the figures, the 18" and 10" pipelines maintained an average water cut of 40–60%. The XSENS Meter measurements were largely consistent with manual sampling, though some minor discrepancies were noted.

In the 18" line, manual sampling was performed at the top of the pipe. At flow rates of approximately 1 m/s, some water-oil separation is expected; this likely caused the manual samples to reflect a lower water cut than the actual pipeline average. For the 10" line, the specific location of the sampling point was not provided.

No manual sampling was conducted for the 12" line, as the operator assumed a constant 0.5% water cut. However, the XSENS Meter detected significant spikes reaching 12–13% during high-flow sequences. Furthermore, the meter's multipath capabilities (measuring at both the 3 o'clock and 6 o'clock positions) allowed us to verify water separation during a period of zero flow (15:30–15:55). This was confirmed by the Speed of Sound (SoS) data: the SoS decreased at the 3 o'clock position and increased at the 6 o'clock position, indicating a higher concentration of water at the bottom of the pipe.

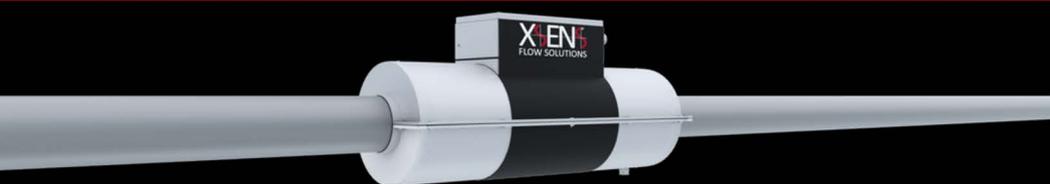
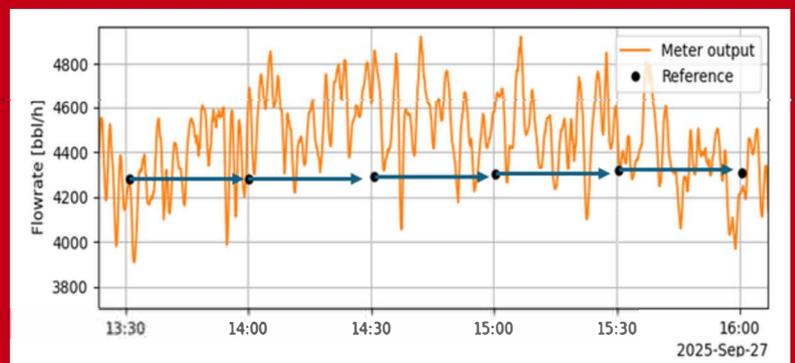


TEST RESULTS - FLOW RATE

Although flow rate comparison was not the primary focus of these tests, data for the 18" line is included below. On average, the XSENS Portable Meter showed a 4% difference compared to the reference turbine meter. This performance aligns with the portable unit's trial specifications. For comparison, a permanently installed XSENS Meter maintains a higher accuracy specification of $\pm 1\%$.



Registered volume in (BBL) @ 30mins interval from each station							
TIME:	STATION	STATION	STATION	STATION	TOTAL	XSENS VOLUME	DIFF (%)
13:00 HRS							
13:30 HRS	744	877	47	473	2141	2260	5.7
14:00 HRS	749	868	49	475	2141	2170	1.4
14:30 HRS	746	872	46	480	2144	2280	6.3
15:00 HRS	744	884	48	475	2151	2265	5.4
15:30 HRS	743	890	49	477	2159	2262	4.8
16:00 HRS	748	882	46	476	2152	2187	1.6



DISCUSSION - WATER CUT

12" Pipeline

XSENS water cut readings remained consistently low (near 0%) but successfully captured intermittent spikes of 12–13%. During zero-flow periods, the meter's multiple measurement paths detected a change in the Speed of Sound, clearly identifying the onset of oil-water separation. This confirms the XSENS Meter's ability to detect stratified layers and provide accurate measurements even under separated flow conditions.

18" Pipeline

XSENS readings compared to manual sampling showed a consistent average absolute difference of 2.5%. Manual samples were slightly lower than XSENS data; however, because samples were drawn from the top of the horizontal pipe, they likely missed water settled at the bottom. This sampling position likely accounts for the minor variance.

10" Pipeline

Comparison with manual sampling showed an average absolute difference of 6.5% across three samples. The XSENS Meter captured rapid fluctuations, including shifts exceeding 20% water cut in under 10 minutes. These highly dynamic conditions make manual sampling comparisons difficult, as even slight timing discrepancies between the sample pull and the digital reading can lead to variance.

DISCUSSION - FLOW RATE

The 4% variance between the XSENS Portable Meter and the reference turbine meter is well within the trial specifications for the portable unit. These results confirm a strong correlation between the two technologies.

CONCLUSIONS

- **Water Cut Accuracy:** Excellent correspondence was observed, particularly in the 40–60% range. The meter proved more reliable than manual sampling in capturing rapid fluctuations.
- **Flow & Volume:** The ~4% average deviation in 30-minute accumulated volumes aligns with the XSENS Portable Meter specifications, demonstrating high measurement reliability.
- **Phase Separation & Transient Detection:** The trials successfully validated the meter's ability to detect oil-water separation and identify transient water spikes that manual sampling would otherwise miss.



CONTACT

XSENS FLOW SOLUTIONS
Godviksvingene 127
5179 Godvik, BERGEN
NORWAY

Phone: +47 55310100
Email: post@xsens.no

