WHITEPAPER - AUGUST 2021

ENSURING CORRECT WATER INJECTION FLOW WITH MULTIPATH CLAMP-ON ULTRASONIC METERING

Accurate Offshore Water Injection Flow Metering
in a Heavy Noise and Vibration Environment

WATER INJECTION METERING

Written by: Kjell-Rune Toftevåg, Kenneth Olsvik, René Haugsdal, Remi Askeland

This platform in the North Sea has since 1998 utilized Water and Gas injections to improve production from the field. New nearby subsea fields are also supported with water injection from the Process platform.

The subsea field is operated by another Operator. Therefore, accurate flow of injection water is very important for the operator of the subsea field to ensure correct amount of water flow into their injection wells, as well as ensuring correct billings by the Operator supplying the water.

To measure the flow accurately, the Operator relied on traditional single path clamp-on flow meters which were highly inaccurate. To improve the measurement, Operator purchased and tested two Xsens Flow Meters to deal with this issue and build trust in their Flow Metering.

WHAT'S INSIDE THIS ISSUE:

Accurate multipath ultrasonic measurement despite noise and vibration on a Water Injection application in the North Sea

XSENS® FLOW SOLUTIONS

WWW.XSENSFLOW.COM

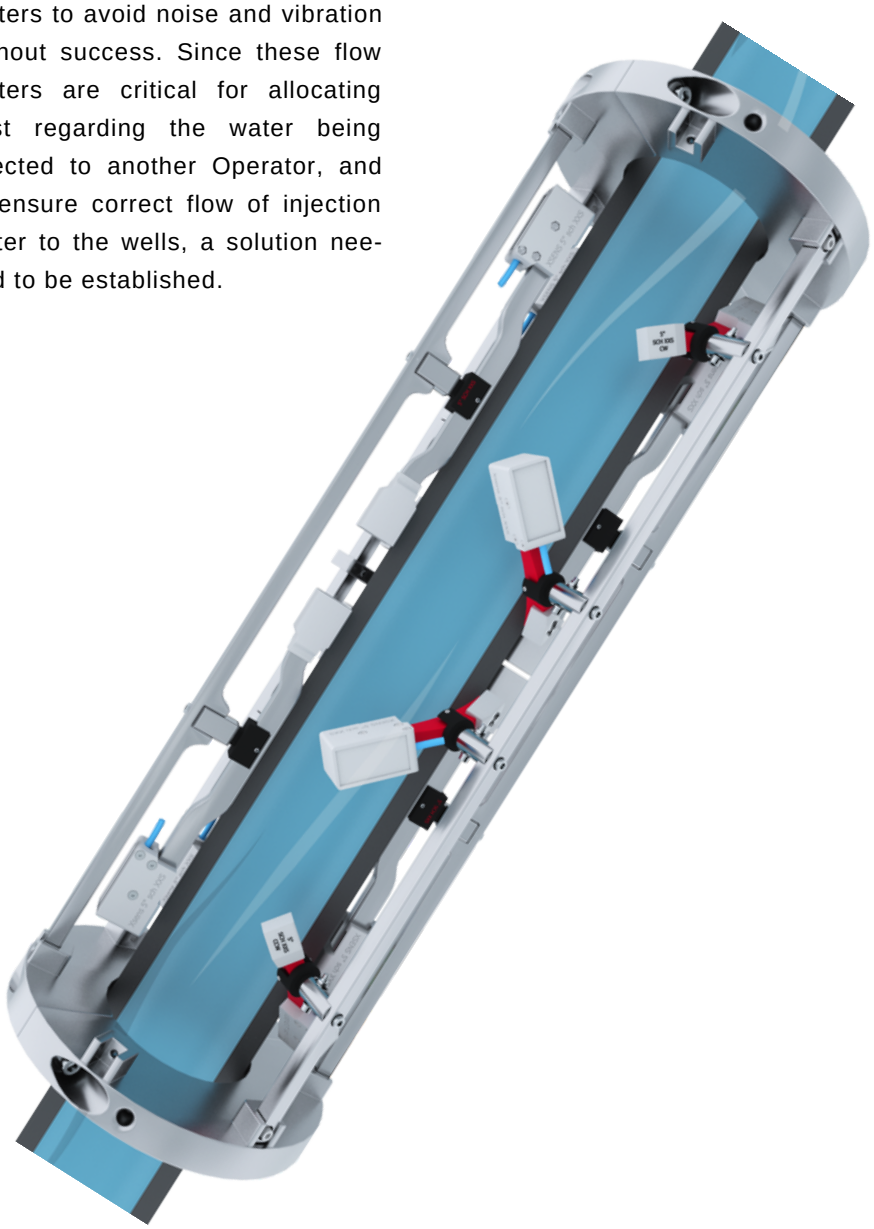
CUSTOMER PAIN

The Operator did not trust the readings of the traditional single path clamp-on flow meters due to significant deviations in flow rates. There was a suspiscion that the mechanical and/or electrical pump noise was interfering with the signals. When the dumping valve between the two flow meters was closed, the flow output from the low and high pressure installations gave huge deviations, while they should have shown similar flow rates.

The Operator had tried to move the portable single path ultrasonic meters to avoid noise and vibration without success. Since these flow meters are critical for allocating cost regarding the water being injected to another Operator, and to ensure correct flow of injection water to the wells, a solution needed to be established.

Based on the Operator's positive experience with Xsens meters at two different sites, the XSENS flow meters were purchased to solve the problems due to it's patented helical multipath ultrasonic signal which allows for high accuracy measurements in challenging conditions.

In addition, the XSENS clamp-on design allowed for an installation without stop in production and not breaking any pressure integrity, which keeps cost low while ensuring high reliability.



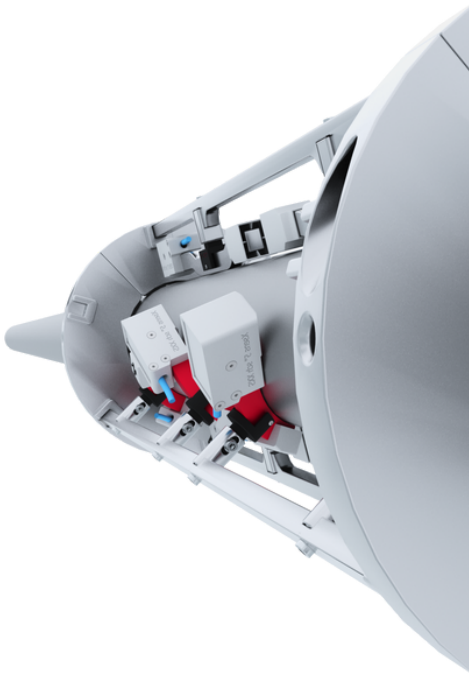
XSENS SOLUTION

To initiate the commissioning test, two XSENS clamp-on flow meters were installed at the Process Platform. An 8” meter was vertically installed and another 10” Meter was installed horizontally as seen in the pictures on this page.

The commissioning test was initiated with XSENS's patented disruptive ultrasonic flow meter technology with helical signal transmission.

This enables off-center and highly accurate pattern measurement with accuracy similar to in-line multipath flow meters. In addition, the XSENS clamp-on design simplifies installation, commissioning and maintenance compared to in-line flow meters.

Therefore, the installed cost for this commissioning and for typical installations is low, while potential leakage points are eliminated as well.



COMMISSIONING TEST RESULTS

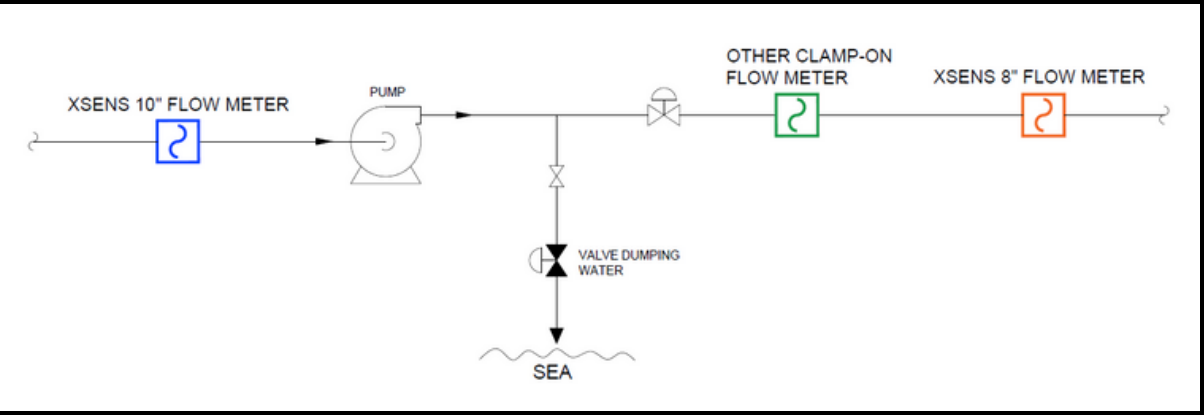
We tested the flow rates on both Meters to verify that they gave similar flow rates and same flow rate as expected from the pump.

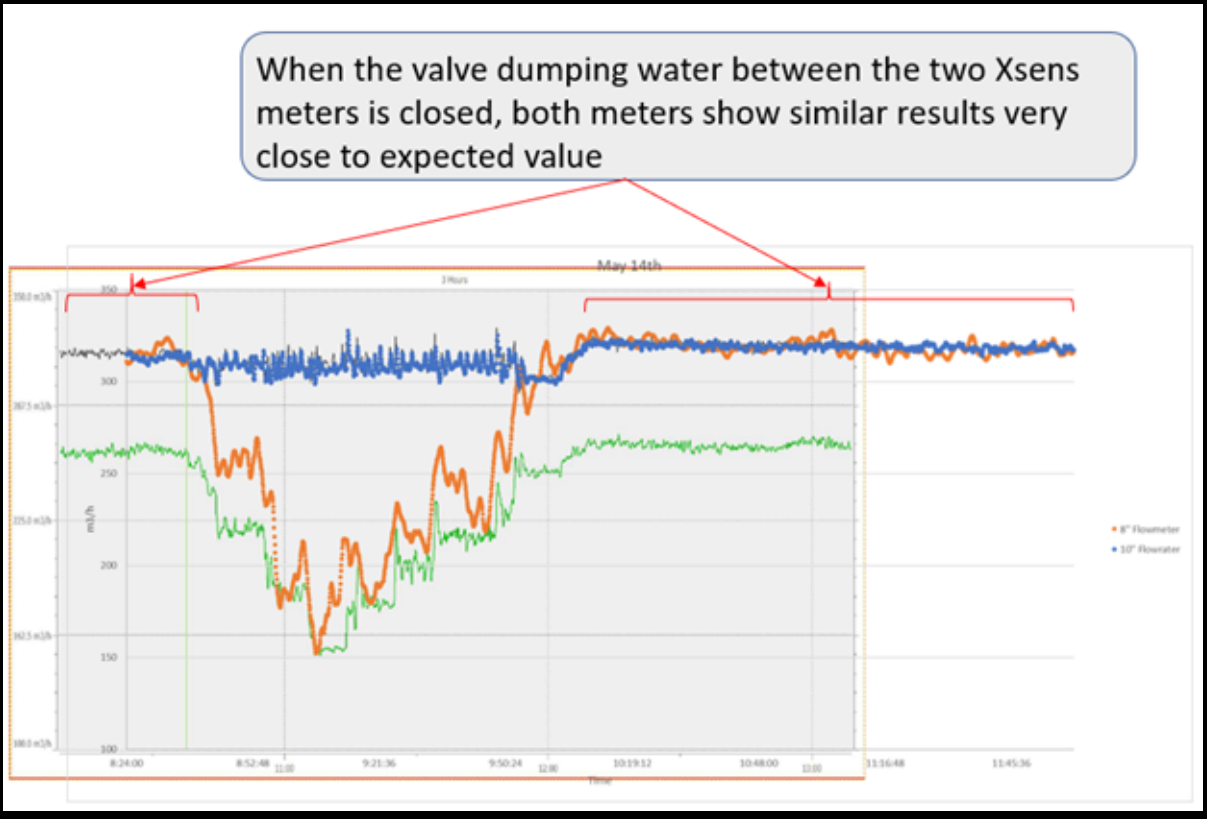
In below graph, the first part of the test results show that the orange line *(8" Xsens Flow Meter)* and the blue line *(10" Xsens Flow Meter)* gave similar flow rate results and very close to the expected flow rate from the pump of 320 M3/hr. The green line is from the older traditional clamp-on Meter and clearly shows a big gap of roughly 50 m3/hr between the expected flow and measured flow.

In the second part of the test, a valve is opened to dump a large part of the water flow. This can be seen when the orange line *(8" Meter, after the valve)* drops compared to the blue line *(10" Meter, before the valve)*. The difference between the orange and blue line represents that water has been dumped and is measured accurately.

The third part of the test consisted of closing the valve gradually again to get back to normal flow. The Xsens Flow meters are then showing results very close to the expected flow rates and are not disturbed by any vibrations or noise. The traditional clamp on flow meter however, represented in the green line, returned to measuring the flow with a big gap of +/- 50M3/hr compared to the expected flow rate.

The XSENS Multipath Ultrasonic technology with it's clamp-on design have resulted in a successful test, clearly outperformming the traditional clamp-on single path technology which the Operator has been using before.





ABOUT XSENS FLOW SOLUTIONS

XSENS Clamp-on Flow Meters accurately measure flow rate and fluid fraction from outside of the pipe. The disruptive XSENS ultrasound technology adds the required accuracy and fluid quality measurement capabilities to clamp-on flow measurement, demanded by the industry for decades.

Xsens have tested the liquid flow meters in Christian Michelsen Research (CMR, now called NORCE) third party approved multiphase test flow loop for flow rates and water cut, and specifications for accuracy are based upon such testing. In addition, we have performed third party tests on our Meters for gas operation with small amounts of liquid present with Equinor, and by such received order for more than half a dozen gas meters from the same oil company.

For liquid meters we have carried out 11 field trials and received orders from oil companies like Chevron, AkerBP, ConocoPhillips, Saudi Aramco, including reoccurring orders from the same oil company.

Our goals are to significantly reduce cost for accurate flow and fraction measurement in any industry while providing the benefits of clamp-on installation which enables safety and retrofit installation. XSENS received the Spotlight Award for the Most Innovative New Technology at Offshore Technology Conference in Houston 2019, and in 2020 XSENS won the ADIPEC Award for Best Oil and Gas Start-up Company.

XSENS TECHNOLOGY

RELIABILITY

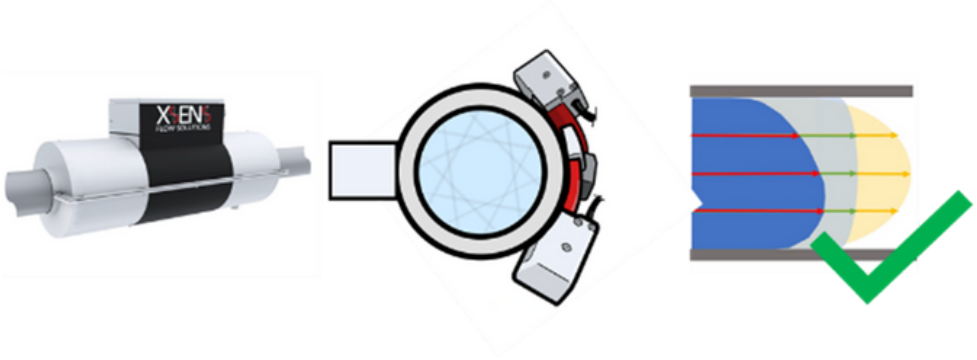
The XSENS Meters use two independent sets of transducers: axial and helical transducers to obtain very high accuracy performance.
These transducer pairs are completely independent of each other. This design, together with the capability of having a total of up to six pairs of transducers, ensures redundancy.

Xsens applies a spring-loaded transducer design that together with a solid compound ensure ideal contact between the transducers and the pipe wall (no use of gel coupling medium that will dry up and disappear during time). The firm enclosure also ensures protection for the transducers and contribute to the 25 years lifetime of our meters.

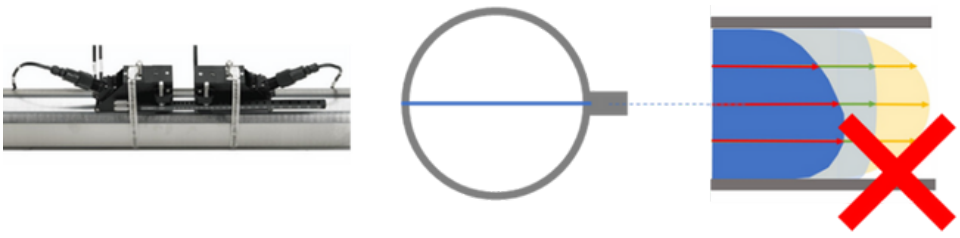
XSENS® FLOW SOLUTIONS

ACCURACY

Clamp-on Meters have in the past performed poorly when it comes to accuracy. Xsens believes this was caused by single path meters relying on models and external inputs for estimations of flow profile and overselling the technology in the early days. Today, existing Meters have a much better performance and have started to gain market access in several industries.



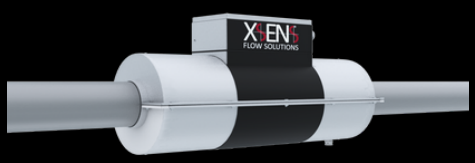
XSENS combines helical formed transducers, axial transducers and measurements of guided wave transmission technology. The pipe wall is used as an advanced gateway between sensors and signals propagated helical as well as axially in the pipe and therefore, accuracy has been lifted to another level.



CONTACT

XSENS FLOW SOLUTIONS
Godviksvingene 127
5179 Godvik, BERGEN
NORWAY

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



WWW.XSENSFLOW.COM