

Colorado Oil and Gas Producer Uses Mass Flowmeters for Wellhead Allocation

Entrained gas measurement features provide huge operational benefits

By Steffen Baecker and Bob Phagan

A Colorado energy producer is taking advantage of new Coriolis mass flowmeter technology that ensures both stable and uninterrupted measurements of oil with high gas content. The new meter is cost effective, rugged, and reliable technology that helps them meet investors' needs for accurate and reliable well allocation measurement information.

Independent energy company looking for cost effective well allocation metering

Denver-based Bonanza Creek Energy, Inc. is an exploration and production company focused on extracting oil and associated liquids-rich natural gas in the United States. The company has operations in Colorado's Denver-Julesburg Basin, a major oil and gas field that is being actively developed through the use of horizontal drilling and multi-stage fracture stimulation.

Bonanza Creek is developing its assets in the basin by drilling horizontal lateral wells. They needed an accurate and reliable way to measure how much oil and water each well was producing. Tank gauging is the standard method used to measure the volume of production at each well. While simple and relatively accurate, tank gauging is time consuming, costly, and entails some safety risks. To account for the production variations among the wells and provide accurate well allocation measurement information, each well on a pad had to flow into a separate tank.

Bonanza Creek was looking for a cost effective way to provide an accurate oil meter at each wellhead, where the oil flows into a separator that separates the water, gas, and oil. They anticipated there would be gas entrained in the fluid coming out of the separator, so they needed an option that could handle entrained gas.

Gas entrainment refers to the presence of gas bubbles in hydrocarbon fluids. Entrained gas can disturb the sensitivity of mass flow measurement of liquids, decreasing accuracy or even stopping measurement completely. It can occur for many reasons, for example, due to degassing; leaks upstream of (or in) a negative pressure area; excessive cavitation and levels falling below the minimum in supply containers, as well as agitators in tanks; or long drop distances for media into tanks. Entrainment can also occur due to status transitions in process control, such as when starting, shutting down, or cleaning the system.

New technology ensures stable measurement even with high gas content

Knowing that Bonanza Creek was seeking an accurate oil meter that could handle gas entrainment, Bob Phagan, sales engineer for I.C.S. Sales, arranged a demonstration of a new mass flowmeter device that is “gas bubble resistant.” I.C.S. Sales is a leading manufacturer’s representative in the Rocky Mountain Region, specializing in process instrumentation.

The new meter, the OPTIMASS Coriolis mass flowmeter, developed by KROHNE Inc., offers reliable indication of gas bubbles in a process by using a combination of various measurements to detect a two-phase flow. The meter detects and signals gas entrainment reliably and maintains the active measurement in all measuring conditions with gas content from zero to one hundred percent by volume. The measuring sensor and signal converter were designed to offer complete digital signal processing, from the production of the drive oscillation of the measuring tube to the evaluation of the sensor signals. The meter maintains continuous mass density measurement and provides measured values at all times. At the same time, it can report the two-phase status and output a preconfigured alarm, in accordance with NAMUR NE 107 requirements.

“We knew the new technology would be the best way for them to handle entrained gas in this application, and the demonstration showed them clearly how the meter could help,” said Phagan. He explains that for this application, The OPTIMASS meters are installed on the crude oil leg of the oil/water/gas separator. Less expensive metering technology is used to meter the water, since it is of lower value to investors. Gas is metered using differential pressure (DP) devices.

After purchasing the first 30 meters in 2013, Bonanza Creek compared the tank volume versus the metered volume over a 24 hour period and found only minor differences in the measured values. These minor differences in the measured volumes were due to the phenomenon known as shrinkage. They have since installed more than 400 OPTIMASS meters. Bonanza Creek can now accurately manage wellhead allocation, and provide stakeholders critical production data.

The model used depends upon the required accuracy. Private leases use the OPTIMASS 1400, which offers a published accuracy of 0.15 percent, while the OPTIMASS 6400 model is used for Federal Bureau of Land Management leases, with a published accuracy of 0.10 percent. The OPTIMASS 6400 has been approved for custody transfers of both liquids and gases, making it ideal for process industries and specialist applications like LNG, CNG, or supercritical gases in terminal or storage/bunkering, along with custody transfer applications.

Figure 1 shows the meters in operation. The picture on the top left is an OPTIMASS 6400 in a separator dog house. The top right photo shows an OPTIMASS 1400 with a remote mount, and the picture on the bottom shows a row of separators, each one with an OPTIMASS 6400.

The meter is the first Coriolis mass flowmeter in the world to feature advanced entrained gas management (EGM), with no loss of measurement with gas entrainment up to 100 percent of volume. Unlike other mass flowmeters, where relative movement between gas and fluid dampens the amplitude of the measuring tube and interferes with the electronics’ capability to determine the actual resonant frequency, the OPTIMASS models with EGM can follow and correct for the varying am-

plitudes. EGM continues to present an actual measured reading, together with an indication or configurable alarm that improves processes by identifying transient gas entrainments.

“Bonanza Creek has found the meters to be rugged and durable and the price compared to other options is a great benefit to them,” said Phagan. “They have also found entrained gas management to be another huge benefit to their operations.”

Figure 1



The new meters are now being used at other exploration and production companies working in the Wattenberg Fields. After a head to head demonstration and evaluation comparing OPTIMASS meters to a competitor meter without EGM, one major energy company purchased and installed about 180 OPTIMASS meters in 2015, and expects to purchase at least 60 more in 2016.

Byline:

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