



How LACT units improve producers' bottom lines

Reduce measurement uncertainty associated with manual processes.

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Lease Automatic Custody Transfer (LACT) units can improve producers' bottom lines by reducing measurement uncertainty of the fiscal transfer of crude oil. "Custody transfer" refers to the transfer of liquid hydrocarbon (crude oil, natural gas liquids or other products) from an oil producer to a purchaser of the product. The transfer of the product (crude oil) can be unattended and is automatic from the producer's "lease," or site, to the customer and is typically transferred via truck, rail or pipeline.

The main purpose of a LACT unit is to accurately measure the quantity and quality of the crude oil that passes through it. The American Petroleum Institute (API) publishes industry standards and practices that outline the specifications for LACT equipment. This is found in API's Specification 11N, Fourth Edition, dated Nov. 1, 1994.

From a producer's standpoint, several key industry challenges arise during the custody transfer of their crude oil. Topping the list are:

- How to safely move products from producer to buyer
- How to get paid for what is produced with measurement accuracy and consistency
- Theft prevention

Monitor crude oil effects

LACT units have significant operational and financial benefits to producers and purchasers. To better understand the impact and benefits that an LACT unit delivers, the understanding of the impact that temperature, API gravity, and basic sediment and water (BS&W) have on the quality and quantity of crude oil is essential.

Temperature — Temperature affects the actual volume of crude oil. As the temperature of crude oil increases, its density becomes lighter, which increases its actual volume. The reverse is true when temperature decreases. To complicate matters even

more, the volume of different crude oils change differently with temperature. The API developed tables that determine the amount of this change based on the API gravity of the crude oil. This change in volume is why the volume of the crude oil is corrected to a standard temperature, usually 60°F.

API gravity — API gravity is a measurement used in the oil and gas industry to describe how heavy or light a crude oil is relative to water. The higher the number, the lighter the product, with water having an API gravity of 10. The actual calculation is:

$$\text{API gravity} = (141.5/\text{specific gravity}) - 131.5$$

This is an important number since it helps define the value of crude oil.

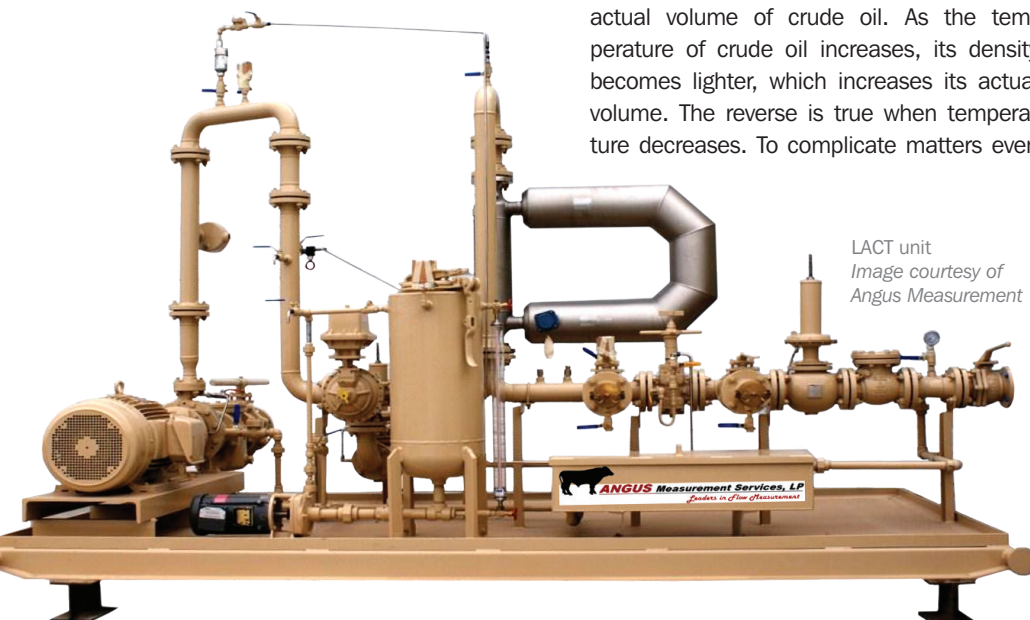
- Light — API > 31.1
- Medium — API between 31.1 and 22.3
- Heavy — API between 22.3 and 10
- Extra heavy — API < 10

As a side note, API gravity is a relative density measurement and is commonly interchanged with specific gravity.

BS&W — Basic sediment and water refers to specific impurities in crude oil. Because they are impurities, not the actual product being sold, they must be accounted for.

LACT value

With LACT systems, the need to witness each transfer of crude oil is eliminated because the transfer is done automatically. This reduces manpower, can improve truck and rail throughput and moves the burden of accurate measurement from the transporter to the measurement skid. This also



LACT unit
Image courtesy of
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reduces human exposure to potentially harmful environments such as climbing on the crude oil tanks and encountering hydrogen sulfide gas. LACT units are proven, meaning the performance of the measurement skid is verified. This is done in consistent intervals, usually based on the contract between the buyer and seller, with the timing of the proving interval based on volume throughput of the LACT unit. This gives the producer and the purchaser high confidence in the measurement integrity of actual volumes sold, reducing measurement uncertainty. The uncertainty requirement is defined by a contract between the buyer and seller, but usually follows industry standards. By metering the fluid, both parties obtain verifiable accuracy, diminishing concerns of poor or unreliable measurement. This is extremely important to producers since once the product passes

a custody point, the volume transaction is considered final.

In addition to metering the crude oil, the LACT unit also instantaneously and continuously monitors the amount of water in the crude oil stream. If the amount of water detected is greater than the purchaser will accept (by contract), immediate action can be taken, including the termination of product being sold. One benefit of LACT systems, if desired, is the ability to automatically — and with no human interaction — circulate a high BS&W crude oil stream to a tank until the oil is merchantable. This results in more loads transported as well as fewer loads being rejected. Remote notification capabilities can be incorporated as part of the system.

To address the quality of the crude oil, LACT units incorporate automated compos-

ite samples of the crude oil whenever the LACT unit is running to ensure a representative sample of the product being sold exists. Automated BS&W samples versus the reliance on manually taken, hand-entered samples improve the reliability and accuracy of this measurement. The correction for the change in volume because of temperature is also done automatically, again reducing the errors associated with manual observation of the actual temperature followed by hand-calculating the corrected volumes.

LACT units do not rely on tank measurements because they meter the crude oil directly as opposed to determining the volume by a change in the crude oil's tank level. This eliminates the need for the verification of tank-strapping tables and the many manual measurements required for each transaction. The age, condition and



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LACT	Equip.	Testing freq.	Uncertainty
Vol.	Meter	1 time per month	0.0025 reproducibility 0.0005 repeatability
Temp.	RTD	1 time per month	+/-0.2°F
BS&W	Sample system	1 time per month	0.001
API gravity	Sample system	1 time per month	+/-1° API

TANK	Equip.	Testing freq.	Uncertainty
Vol.	Manual (Gauge type)	118 times	+/-0.25"
Temp.	Manual (Certified thermometer)	118 times	+/-1°F
BS&W	Manual (Top & bottom samples)	118 times	0.10%
API gravity	Manual	60 times	+/-1° API

Table 1. LACT versus tank

temperature calculations of the tank and/or the equipment used to take the measurements do not impact the accuracy of the custody transfer.

As opposed to manually taken measurements written on hand tickets, the use of LACT systems provides backup for any disputes. For example, if a density or temperature is input incorrectly, the hand ticket must be disputed and resolved, if it is even noticed. With a LACT unit, these measurements are automatic and electronic records can be kept as an audit trail.

Real-world example

One example shows how a LACT unit can reduce measurement uncertainty and manpower requirements. Table 1 is based on a producing field that produces 10,200 barrels of oil per month. The average truck load is 170 barrels. This equates to 60 loads per month (10,200/170). The testing requirements are technology-independent and include the volume, temperature, BS&W and API gravity on the Y axis and the equipment required, the testing fre-

quency and the uncertainty of the measurement on the X axis.

In one month, on the manual tank runs, the level gauge had to be read 120 times to within +/- .25 of an inch. The temperature had to be taken 120 times to within +/- 1°F and the BS&W had to be sampled 120 times to within 0.1 percent (BS&W is multiplied by two because the top and bottom of each tank must be determined and then averaged). If not witnessed, the accuracy and/or consistency of these measurements are commonly called into question. Additionally, the API gravity had to be manually taken 60 times.

The example below shows the financial impact of these uncertainties involving a 500-barrel tank that contains 480 barrels of fluid and ~33 barrels per foot or 2.75 barrels per inch.

- The opening tank gauge read a ½-inch low and the bottom gauge read a ½-inch high, equaling 2.75 barrels of production given away.
- If the tank temperature is off by +6°, 1.42 barrels of production are given away.

- If the BS&W is off by .25 percent, 1.2 barrels of production are given away.

In this example, the producer does not get paid for 5.37 barrels per tank load. The potential loss of revenue to the producer at \$50 per barrel is \$268.50 per tank run. If a company averages 500 tanks per month, this equates to approximately \$134,250 per month in revenue lost, or about \$1,611,000 lost per year. Another way to look at this is a loss of 223.75 barrels of production each day (41.67 tanks/day x 5.37 oil barrels).

In conclusion, LACT units reduce measurement uncertainty associated with manual processes, making them a critical component to help producers achieve their key objectives of safely transferring products to buyers and getting paid for what is actually produced while helping deter theft. **FC**



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