

Oil & Gas Custody Transfer

Crude Oil

Crude Oil	Natural Gas Distribution	Natural Gas Liquids	Refined Products
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Crude Oil is the first unit in this four-step overview of the Custody Transfer process

Overview of Crude Oil Process

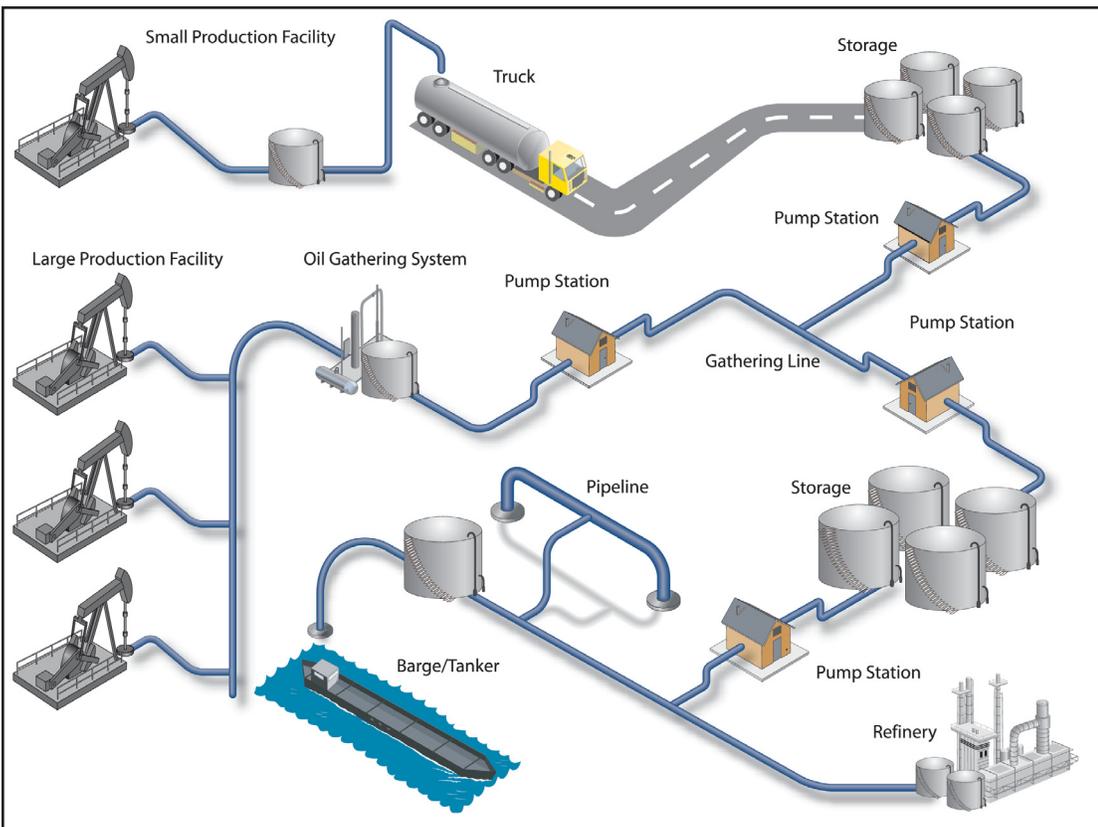
Some 80 million barrels of oil per day is typically transported from producing oilfields around the world. Trucks, trains and pipelines are utilized to move oil over land to high capacity storage terminals, refinery facilities or exportation ports. Tankers ship the majority of the world's internationally traded crude oil from producing to consuming nations.

Small diameter 'gathering' pipelines (approximately 2-8 inches in diameter) collect crude oil from different oil production facilities into central storage facilities or into 'trunk' lines (generally 8-24 inch diameter) which move oil in bulk over great distances. Crude oil may be stored in tanks at a storage terminal to better manage changes in supply and demand. A storage terminal may also have truck and rail car off-loading facilities to support other means of oil gathering transportation.

Crude oil pipeline companies are generally separate from the producing/receiving companies and only provide transportation services for crude oils that vary widely in density, viscosity, sulfur content, and in other fluid properties. As such, pipeline operations regulate the amount of water and sulfur that can be transported and end-users strictly specify by contract the oil quality that they are purchasing.

Computer-aided automation systems - located in central control rooms - monitor rates of flow, pressures and fluid characteristics to quickly detect possible pipeline leaks and to control pipeline valves and pumps to ensure contractual demands are met. Real time data regarding crude oil quantities injected into and delivered through the pipelines allows the efficient batching of differing crude oil types with varying characteristics.

Custody transfer measurements are made at every change of ownership to account for proper payment to suppliers and the appropriate invoicing of transportation costs. The same measurements are often used to allocate payments to partners in producing facilities and/or designate costs to divisional operations within a single oil company.



Process Diagram Oil & Gas Custody Transfer - Crude Oil

Custody transfer measurements (pay and check) exist at any point in the process where there is a transfer of ownership

Customer Challenges Overview

Operators of crude oil pipelines and transportation networks are committed to the protection of the environment and operation of their facilities in a prudent and safe manner. Increasing and optimizing throughput and realizing cost efficiencies through operational improvements are primary day to day challenges.

Regardless of the method of transportation, crude oil metering systems must provide accurate fiscal measurement over time, demonstrate a high level of reliability and provide opportunities for cost reductions (operating and capital) without impacting measurement performance.

Measurement performance is often monitored through the regular (monthly) in-line proving of the meters under actual field conditions. Internal and/or contracted service providers use volume provers or master meters to compare meter factors and repeatability. These factors are used to correct the quantities metered for billing and to assess the performance of the meter over time.

Customer Process Challenge #1 – Crude Oil Gathering System

Challenge: Multiple production points supply oil to the main pipeline with crude oil flow rates and densities that vary based on what wells are producing at one given time. These variations, along with different contaminants in the oil (sand, entrained gas), create a challenging environment for maintaining meter accuracy and reliability while minimizing maintenance costs associated with wear and damage. The requirement for daily over/short pipeline balance accounting requires sustainable flow measurement accuracy at every interconnect to the pipeline in addition to the required accuracy of the main line meter. Maintaining pipeline gathering throughput is critical to meet demand and any need to drain the line to remove equipment from operation involves costly maintenance and oil disposal procedures.

Customer Process Challenge #2 – Loading of Crude Oil onto Truck, Rail or Barge

Challenge: Loading facilities go from stop to full flow quickly and may contain air in the line or hose. Facilities without real time flow computers have to calculate the volume of the load based on a flow weighted average temperature and density reading. Prior to and at the end of a fixed volume interval (i.e. every barrel) temperature and density readings are obtained, averaged and then used to calculate actual volumes. Knowledge of the quality of oil being loaded is necessary to suspend operation if restrictions on water content are not met. Weight of the load is required to meet regulatory compliance for transportation. In the case of trucking, economics dictate the meter be mounted on the truck.

Customer Process Challenge #3 – Pipeline Leak Detection

Challenge: Pipeline operators face the potential of leaks that statistically occur once every 20 years on short lines and every year on pipelines over 1000 miles long. Safety (fires, explosions, injuries and fatalities), environment (uncontained hazardous materials) and economic loss (property damage and stock loss) are serious challenges. Quick response and an estimate of location and size of the leak will minimize the overall damages incurred. Aging facilities and government regulations are increasing the need for leak detection or in some cases, flow reconciliation for pipelines.

Customer Process Challenge #4 – Chemical Injection

Challenge: The varying properties of crude oil can result in the presence of corrosive contaminants and fluid properties ranging from water to asphalt. A variety of chemical additives are often injected into a pipeline to minimize corrosion, increase the quantity of oil that can be delivered and reduce pumping costs. The quantity and type of chemical used can vary with pipeline throughput and the adoption of newer, improved additives.

Improving Process Efficiency

Recommended Product Solution

Challenge #1 – Crude Oil Gathering System

Customer Challenge: Precise fiscal measurement over time, with a high degree reliability and lower cost of ownership.



Solution: Micro Motion meters offer sustained accuracy over time and the largest turndown ratio available for custody transfer quality flow meters under changing fluid properties. No moving parts and the fact that the Coriolis meter is not damaged by slugs of air/gas or by sand in the oil reduces the likelihood of measurement performance degradation or having to stop pipeline flow to perform maintenance. This increases the availability of the pipeline to transport oil, reduces maintenance and eliminates the need for added meter proving. Remote/local diagnostics, including advanced features such as meter factor validation or coating detection, can eliminate the need to empty the line for visual inspection. Our ability to accurately measure density provides a needed variable for standard volume calculation and a process variable that can monitor crude oil quality and/or interface detection. All information is available digitally for real-time communication of data to pipeline control including alarm options for notification of pipeline upsets.

Competing Technologies: Mechanical or positive displacement meters are most prominent within crude oil gathering facilities and are susceptible to measurement performance degradation due to turndown, fluid properties and contaminants in the oil. Other Coriolis technology often lacks the mass and density accuracy to ensure optimal measurement performance.

Applications:

- Lease Automation Custody Transfer
- Pipeline Custody Transfer
- Transportation truck loading & unloading
- Railcar loading & offloading terminals
- Large metering systems for terminals
- Full /slip stream Interface detection

Micro Motion Products



Enhanced ELITE



ELITE (1 to 4 inch)



ELITE (1/2 to 1 inch)

Challenge #2 – Loading of Crude Oil onto Truck, Rail, or Barge

Customer Challenge: Precise fiscal measurement over time, with a high degree reliability and lower cost of ownership.



Solution: Micro Motion meters have no moving parts that can be damaged by high velocities of oil resulting from a fast loading operation or slugs of air. Density can be used to detect excess water and/or air which can automatically stop the loading process. Mass, volume, flow-weighted averages, and instantaneous flowing density are measured in a single device thus providing custody transfer flow measurement, weight of the load, and quality monitoring. Eliminating the need for added measurement devices reduces the complexity of the measurement system and increases overall reliability. The robust design of the meter allows mounting of the meter on the truck itself without any degradation of performance over time. Compact, parallel Coriolis metering systems for high volume applications provide improved uncertainty, lower prover costs and offer flexible designs for in-line verification and hot standby meters.

Competing Technologies: Positive displacement meters are common in this application and their mechanical design makes them susceptible to damage from high flow velocities and entrained air. Large capacity Coriolis meters are applied in high flow rate applications.

Applications: Single or multiple metering systems for railcar, truck or barge loading terminals



Enhanced ELITE



ELITE (1 to 4 inch)



D600



CMF400

Improving Process Efficiency

Recommended Product Solution

Challenge #3 – Pipeline Leak Detection

Customer Challenge: Early and reliable detection of pipeline leaks.



Solution: Leak detection systems utilize Micro Motion meters with highly accurate mass flow measurement. Flow can be presented as either mass flow or actual volumetric flow depending on pipeline conditions. For single product pipelines, mass flow without the requirement of pressure and temperature compensation for volumetric measurements, can minimize calculation errors for leak detection. For multi-product pipelines, actual volumetric flow, calculated from Micro Motion mass and real-time density measurement, allows for reliable leak detection without false alarms. The excellent repeatability of the flow measurement is used for trending analysis and the digital information provided by the transmitter updates continuously to provide real-time leak detection monitoring.

Competing Technologies: Positive displacement, turbine and ultrasonic meters

Applications: Flow at either end of the pipeline, as well as, intermediate metering stations which are typically located every 30-100 miles along the pipeline.

Micro Motion Products



Enhanced ELITE



ELITE (1 to 4 inch)



D600

Challenge #4 – Chemical Injection

Customer Challenge: Accurate injection of chemicals with minimal maintenance intervention.



Solution: Micro Motion Coriolis meters reduce both the cost of chemicals and meters used by providing accurate volume / mass measurements over a wide range of injection rates. The ability to handle a broad range of fluid properties makes it a more universal meter for this type of application. Ensuring the correct quantity of ‘drag reduction’ additives can increase the quantity of oil transported in the pipeline while minimizing the energy cost (pumping).

Competing Technologies: A variety of positive displacement meters are used in this application.

Applications:

- Corrosion inhibitor injection
- Drag reducer injection



ELITE (1 to 4 inch)



F-Series (1/2 to 1 inch)