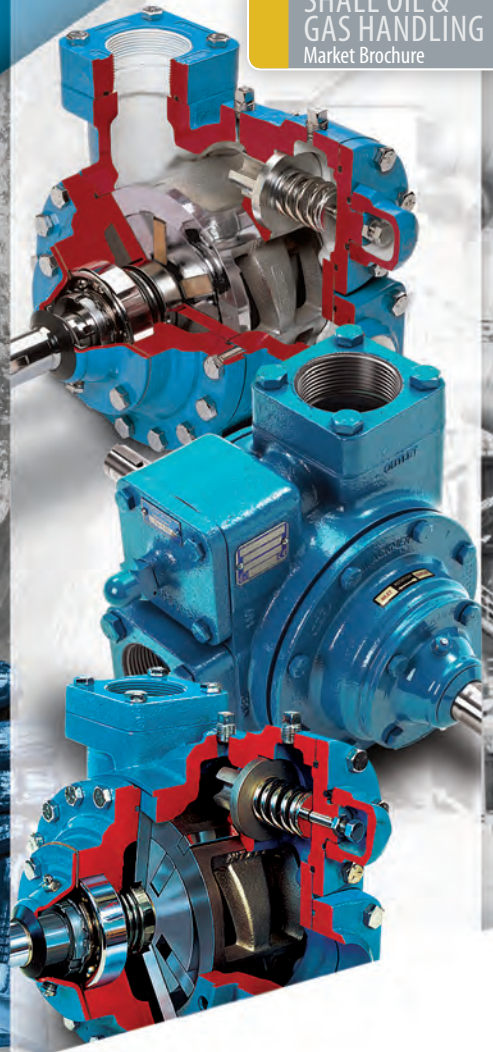


Blackmer
Part of Pump Solutions Group®
A DOVER COMPANY

Expert
Solutions
for Shale Oil and
Gas Handling

SHALE OIL &
GAS HANDLING
Market Brochure



Where Innovation Flows

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SLIDING VANE PUMPS

Shale Oil & Gas: Driving the U.S. Production Boom

The boom in United States oil and gas production is real—the U.S. Energy Information Administration (EIA) predicts oil production will reach **9.6 million barrels** per day (b/d) by 2019 and natural gas production will grow by **56%** through 2040—driven largely by the epic production growth in the most prominent U.S. shale oil and gas plays.

The EIA has reported that exploration and recovery activities in six key tight-oil and shale-gas regions—Bakken, Eagle Ford, Marcellus, Haynesville, Permian and Niobrara—accounted for nearly 90% of domestic oil production growth and virtually all domestic natural gas production growth in 2011 and 2012.

This shale-driven growth creates expanding sales and marketing opportunities for many ancillary industries. In fact, industry studies show pumps used in the North American shale oil industry are expected to have a compound annual growth rate (CAGR) of 8.7% between 2013 and 2020. Among pumping technologies specifically designed to handle shale oil and gas separation, storage and transfer applications, the Positive Displacement Sliding Vane Pump is ideally positioned to help fuel the industry's growth.

Shale Oil: Lighter Than Traditional "Dirty" Crude

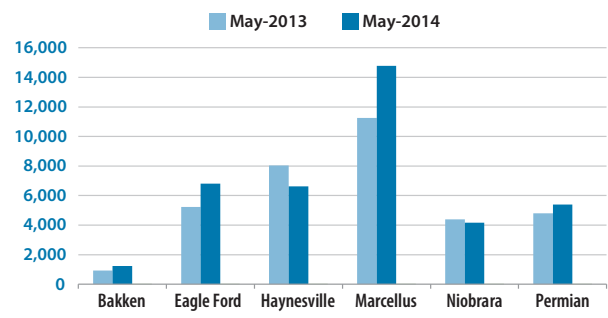
There is crude oil and then there is shale oil. Crude oil produced by traditional drilling is known as "heavy," meaning it has a higher viscosity, specific gravity, as well as a heavier molecular composition, making it dense. Heavy crude oil, has a sulfur content greater than 1% and contains aromatics and asphaltenes.

Oil produced from tight shale formations has different chemical and physical properties. Often called "clean" oil it is much lighter than traditional "dirty" crude oil because of its lower viscosity and levels of impurities, and requires less processing for market use.

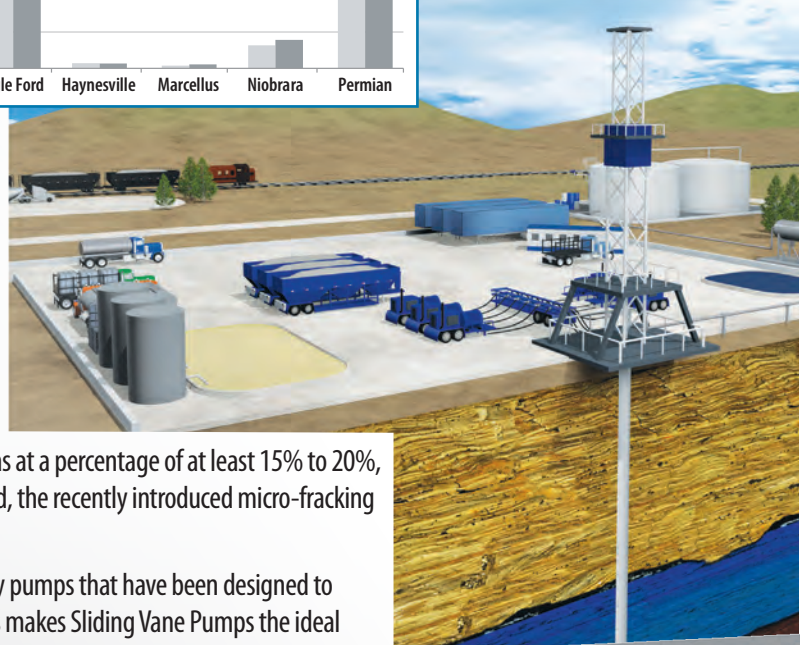
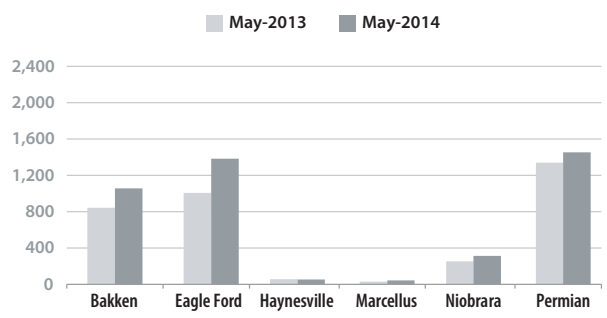
To cost effectively extract the oil from a shale formation, it must contain natural gas at a percentage of at least 15% to 20%, or else it will not flow. As shale oil is typically found thousands of feet underground, the recently introduced micro-fracking technology has opened greater opportunity to reach and extract this clean oil.

Once extracted, the light composition of shale oil requires handling and transfer by pumps that have been designed to efficiently handle liquids of lower viscosities and with lesser particulate levels. This makes Sliding Vane Pumps the ideal choice for shale oil and gas-handling applications.

Natural Gas Production
million cubic feet/day



Oil Production
thousand barrels/day



Surveying the Field: Sliding Vane vs. Competitive Technologies

Pumps are required in shale oil and gas production for transport, in small pipelines and at transfer points in gathering systems, tank batteries or storage terminals.

In addition to sliding vane, other pump technologies that have been used for these applications generally include gear and screw. There are, however, a number of disadvantages to using gear or screw pumps in shale-handling operations:

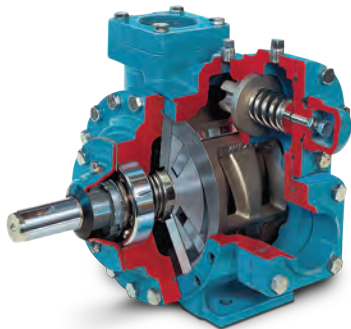
Sliding Vane Advantages	Gear Pump Disadvantages	Screw (Twin) Pump Disadvantages
Excellent on thin, low viscosity liquids	Poor on thin, low viscosity fluids	Very poor on thin, low viscosity fluids
Self-adjusting vanes allow consistent high-level performance	Wear increases internal clearances, product slip and decreases performance	Wear increases internal clearances, product slip and decreases performance
Highest initial energy efficiency is consistent over time	Lower energy efficiency and decreases over time	Lower energy efficiency and decreases over time
Symmetrical bearing support assures even loading and long bearing life	Overhung load on shaft bearing decreases bearing life	Multiple (4) bearing design increases complexity and bearing maintenance
Self-priming	Not self-priming	
Low maintenance cost	Medium to high maintenance cost	High to very high maintenance cost

Blackmer® Sliding Vane Pump Models for Use in Shale Oil & Gas Handling

Known as the global leader in petroleum-flow solutions, Blackmer pumps are widely used to load, transfer and unload petroleum and gases.

Its sliding vane pump technology is considered the world's most effective pump solution for moving thin and medium viscosity petroleum-based liquids, offering the best-combined characteristics of sustained high-level performance, energy efficiency, trouble-free operation and low maintenance cost.

Blackmer offers three models of Sliding Vane Pumps that have been specifically designed to optimize shale oil and gas handling operations:



XL Series

Ideal for use in refineries, pipelines and storage terminals for general processing, filling and transfer applications.

Features & Benefits

- Ductile-iron construction
- Adjustable internal relief valve
- Self-priming and dry-run capable
- Mechanical seals
- Replaceable casing liners and end discs
- Symmetrical bearing support for even loading and wear
- External ball bearings isolated from pumpage
- Easy vane replacement and maintenance



TX Series

Ideal for the transport of clean, light petroleum products, such as shale oil.

Features & Benefits

- Cast-iron construction
- Adjustable internal relief valve
- Self-priming and dry-run capable
- Dual-ended shaft simplifies installation
- Mechanical seals
- Symmetrical bearing support for even loading and wear
- External ball bearings isolated from pumpage
- Easy vane replacement and maintenance



SGL Series

Ideal for use in low-temperature, high-pressure liquefied-gas transfer applications.

Features & Benefits

- Ductile-iron construction
- Adjustable internal relief valve
- Self-priming and dry-run capable
- Cavitation-suppression liner
- Low noise and vibration levels
- Replaceable casing liners and end discs
- Mechanical seals
- Easy vane replacement and maintenance

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