

Coping with Change in Terminal Operations

Tom Stone

Using the best equipment to eliminate the operational “soft spots” can lead to increased ROI.

Without question, liquid storage terminals play an integral part in the ongoing success and relevance of a wide array of industries worldwide. They serve a vital role in the global economy as transfer points from one mode of transportation to another and as safe, secure storage locations until product transfer is needed. The list of products that move through and are stored at liquid terminals is long: from raw crude oil to refined petroleum products, from animal fats to solvents and caustics.

Sometimes, however, money- and time-wasting “soft spots” exist in the liquid-handling systems that deliver the goods. Not all systems are created equal, nor are they created to take optimal advantage of the systems as they have evolved. The problem is, how does a terminal operator ensure time, money and energy are not wasted as they play their part in the supply chain?

For the purposes of our discussion, the classification of liquid storage terminals falls into two general categories:

- **Bulk Terminal:** A facility used primarily for the storage and/or marketing of petroleum products or chemicals, which has a total bulk-storage capacity of 50,000 barrels or more and/or receives products by tanker barge or pipeline. Estimates put the number of bulk-terminal operators in the United States at roughly 1,500 companies.
- **Bulk Station:** A facility used primarily for the storage and/or marketing of petroleum or chemical products, which has total bulk capacity of less than 50,000 barrels and receives its products by rail tank car or truck. There are approximately 2,860 companies that operate bulk stations in the United States.

A generic term for both bulk terminals and bulk stations is *tank farm*, which is defined as “a group of supply or



storage tanks placed together for storage of oil, chemicals, etc.” Using the definitions above, all bulk terminals and bulk stations can be described as tank farms, but not all tank farms can be called bulk terminals or bulk stations.

While these general classifications regarding the capacities of liquid storage terminals remain appropriate, the

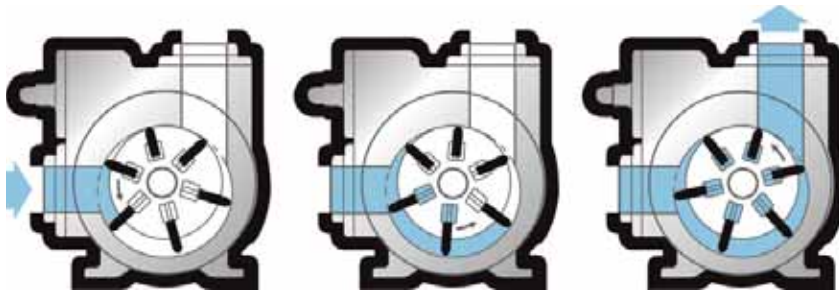


Figure 1. Sliding vane principle

change in terminal operation comes in the constantly modifying and more specific product configurations that pass through them, as well as the types of ancillary operations that terminal managers are now asked to perform on a regular basis.

Diversify and Conquer

When most people think of liquid storage terminals, the first image that comes to mind is the giant holding tanks located at petroleum-refining complexes. These tank farms feature acres of storage tanks, with capacities reaching 50,000 gallons per tank. These facilities serve as a vital hub in the storage and dispersal of numerous types of liquids, including petroleum products and petrochemicals, which are crucial in the world's transportation and manufacturing sectors.

In reality, refinery tank farms represent a small portion of the liquid-storage terminal universe. In addition to crude oil and its petroleum derivatives, tank farms serve as an essential link in the distribution of a wide variety of other products, including:

- Mainstream and niche chemicals (solvents, fertilizers, pesticides and acids)
- Alternative fuels (ethanol and biodiesel)
- Vegetable oils (for food products)
- Animal fats and oils (for cosmetics)
- Molasses
- LPG
- LNG

At some point, any liquid that can be transported in bulk—by ocean-going tank ship, barge, railcar, tank truck or pipeline—is stored and transferred at a liquid terminal with the storage tank operating as the interface between the various transportation methods.

Transferring, handling and storing these liquids can be a daunting task for the facility manager, but these terminals are not just being asked to be a link in the supply chain; they are asked to do much more, especially among chemical distributors. For example, while the large port terminals may just load and unload raw and finished products, the bulk plants may later add blending operations (i.e., ethanol, biodiesel, petroleum additives, etc.) to the loading and unloading duties. Then, at the distributor level, loading, unloading and blending routines are typically joined by mixing and packaging operations before finished products are shipped to the end user.

The Solutions

Somewhat oddly, when liquid-storage facilities are initially built, they often do not make use of the best equipment, relying instead on brands and technologies that get the facility “up and running.” Then, after the facility has been in operation for awhile, the operators identify the inefficiencies and weak links in the enterprise

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and look to “find a better way.” One possibility is sliding vane pumps.

The Sliding-Vane Principle

Robert Blackmer invented the sliding-vane principle in 1899 as an alternative to the inefficient gear-type pumps that dominated the market at the time. Just by the nature of their operation, a gear pump’s flow rate will gradually decay as the pump’s gear teeth wear. On the other hand, sliding-vane pumps feature vanes that slide out of the pump rotor as they wear, meaning there is no drop in flow rate and volumetric efficiency as the pump ages, and when the vanes do reach the end of their useful life, they are easily replaced.

Specifically, sliding-vane pumps have a series of vanes that freely slide in or out of slots in the pump rotor (Figure 1). The pump’s rotation draws liquid in behind each vane, through the inlet port and into the pumping chamber. As the rotor turns, the liquid is transferred between the vanes to the outlet where it is discharged. Each vane provides a positive mechanical and hydraulic displacement of the liquid. Vanes are actuated by three forces: (1) centrifugal force from the rotor’s rotation, (2) push rods moving between opposing pairs of vanes and (3) liquid pressure entering through vane slots and acting on the rear of the vanes.

Therefore, each revolution of a sliding-vane pump displaces a constant fluid volume with variances in pressure having minimal effect. Energy-wasting turbulence and slippage are minimized, and high volumetric efficiency is maintained. Since the vanes constantly adjust to accommodate for wear, unlike gear pumps that are not self-adjusting, sliding vane pumps maintain near-original and consistent volumetric performance over time. Sliding vane pumps also provide a tremendous amount of suction. This suction capability can benefit terminal operators by stripping lines and removing “heel” from tankers.

Because of the design of the pump’s rotor and independent sliding vanes, sliding-vane pumps are easy to

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maintain at peak performance levels and, if necessary, can be completely rebuilt with the piping still attached. In the event the vanes become worn to the point where they need to be replaced, this can be accomplished by simply removing the outboard head assembly, sliding out the old vanes, inserting the new ones and reinstalling the head. In a matter of minutes, the pump can be back in operation. Simple vane replacement also requires no special tools.

For owners of liquid terminals, the result is optimized operating efficiency: less power consumption, less repair and maintenance, less wasted or contaminated product, more speed and precision in loading and unloading, and more consistency in blending.



Conclusion

Volatile prices for raw goods from crude oil to vegetable oil are increasing wholesalers' costs to finance their inventories and accounts receivable, creating a need to squeeze costs out of their operations by boosting efficiency and eliminating waste. At the same time, terminal operators are told they must modernize these operations to make them more efficient and environmentally friendly in terms of energy usage. Coupled with that, federal regulations can mean a forced increase in the market shares for some products, like biodiesel and ethanol, requiring many petroleum terminals to modify or expand their storage facilities and traffic capacity. Compliance with these government and industry standards for fuel specifications demands precise blending.

With a need to boost operating efficiencies and the prospect of upgrading or expanding terminal facilities, a growing number of terminal operators are investigating sliding-vane pump technology and are discovering that they can optimize performance and get measurable returns on their investments with this technology. A concept proven over a 100-year period, sliding-vane pumps consume less power, require less maintenance, offer high suction that helps clear lines, tanks and transports, and deliver precise volumetric consistency in both loading/unloading and blending applications. Sliding vane pumps offer a viable, efficient solution for the growing challenges of operating a liquid storage terminal in today's ever-changing marketplace.

P&S

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