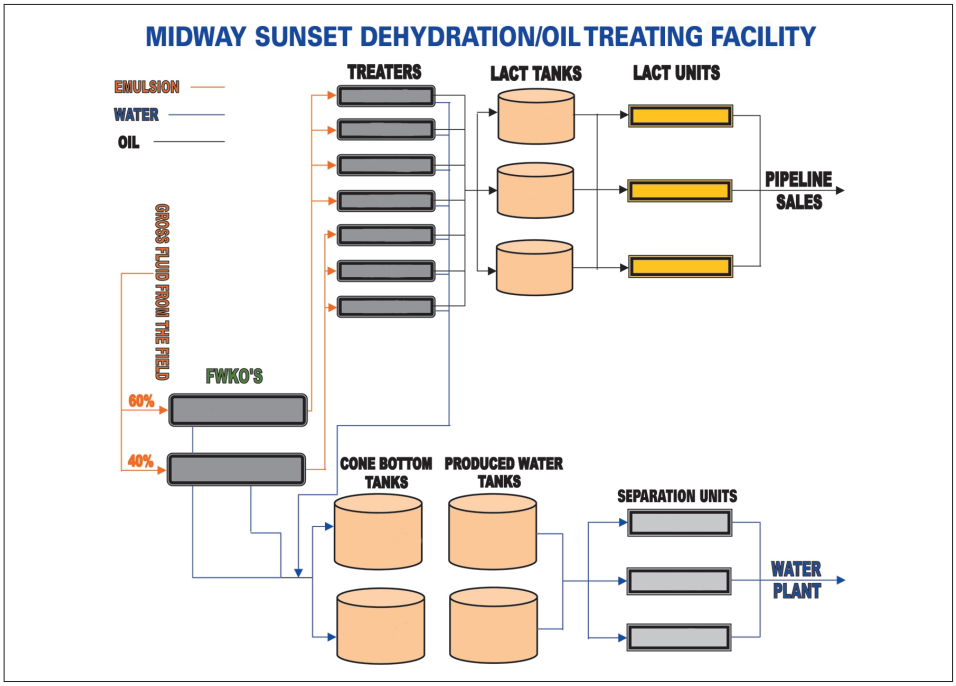
Crude Oil Dehydration Plant Cuts Costs Using New Progressive Cavity Polymer-Metering Pump

By Chris Long and Brent Welling

The need for consistent polymer dosage rates, coupled with high maintenance costs incurred by its existing metering pump, recently prompted a leading West Coast petroleum producer to modify their method of injecting emulsion polymer into crude oil at the company's dehydration plant in Kern County, California. The facility had been using a low-flow reciprocating diaphragm pump for the metering process. By replacing the old pump with a new progressive cavity (PC) metering pump they were able to:

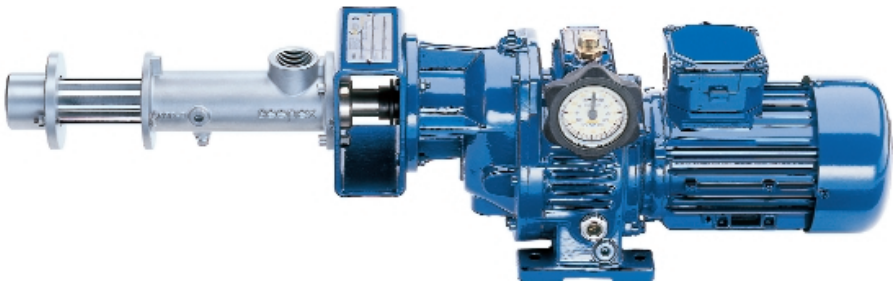
1. Eliminate the bottleneck of inconsistent chemical injection to the system
2. Drastically reduce pump maintenance
3. Improve safety
4. Achieve a payback on the PC unit in its first three months of operation.



Flow diagram of Bakersfield area oil treating and dehydration plant. New metering pump is located at the beginning of the dehydration process where crude oil from the field is being split from main pipeline into separate flows to two free-water knockout vessels (FWKOs).

This Bakersfield petroleum producer generates more than 250,000 b/d of oil and 90 million cu ft of natural gas per day, with proven reserves equivalent to just over one billion barrels of oil. The dehydration plant services an area of 20 sq. mi. near Taft, California, in the Midway Sunset Oil Fields. It has a capacity of processing greater than 20,000 b/d of the field's heavy gravity (12-13 API) oil. The oil is pumped from wells into one of three trunk lines. These trunk lines feed into a single 24" group line supplying the free water knockout vessels at the oil dehydration plant.

After the production leaves the free water knockout (FWKO) vessels, Baker Petrolite RBW 6100 TM (emulsion polymer) is injected into the oil using the PC metering pump. The oil from the FWKO vessels is distributed to seven heater treater vessels where the water content in the oil is reduced to less than 3%. Lease automatic custody transfer units (LACT) then convey the dehydrated oil through pipeline to the refinery.



Water from the heater treaters and FWKOs is transferred to one of two 3000 b/d-capacity cone-bottom tanks, where the solids are jet-washed out, and the water is pumped through additional filtration, clarification, and softening processes, in the tertiary water recovery system. The clean water (less than 5 PPM solids) is then converted into steam by generators, and injected into the formation by way of injection wells. This steam heats the oil, lowers

the viscosity, driving it to the well bore and pumping it to the plant.

At this point Baker Petrolite's RBW 6100 TM emulsion polymer is injected into the production just upstream of the heater treaters. Baker Petrolite is a division of Baker Hughes Incorporated. This emulsion polymer is used for oil/water interface control within the heater treaters.

In the past, a reciprocating-diaphragm-metering pump injected the polymer at a rate of 15 g/d. Due to the pulsating nature of this pump, the polymer will coagulate between the diaphragm and the pump chamber causing downtime (4 - 5 hours/week). The pump required weekly cleaning to remove the coagulated polymer from the pump chamber. During this downtime, the water quality would be below standard because of a lack of polymer treatment. In an attempt to remedy the situation an inline filter was installed between the pump and the polymer to screen out any type of plugging agent; however, the impurities would override the screen, and require labor-intensive cleaning every two days.

Looking for a solution to the polymer injection problem, Baker Petrolite turned to Cortech Engineering, Inc., which supplied the plant with a type 0015-24 MDP PC metering pump manufactured by **seepex** Inc., Enon, Ohio. With a maximum capacity of 3.1 LPH, the new unit consists of 316 stainless steel housing, a Kynar® rotor, and a BUNA stator. In operation, this positive displacement pump's single external helix rotor turns within a molded double internal helix stator to form progressively moving cavities creating the pumping action. The pump's output is directly proportional to its speed, and its customized stator ensures an identical compression ratio along the entire length of the rotor/stator interface. The PC unit, by allowing a continuous pulse-free polymer flow, now does not permit the chemical time to set up and form clogging materials, and the pump's design lets it shear and grind any solid materials that might go through it.

As a result of replacing the reciprocating diaphragm pump with the seepex unit, the plant has received numerous benefits. Since it was first installed in April 2000, the new pump has operated relatively maintenance free, eliminating: (a) the need for an inline screen, (b) the labor previously required for pump repair and screen cleaning, and (c) the extra costs downstream of reworking the sub-standard water. In addition, by eliminating the inline screens, the new pump has improved plant safety, since there is less manual handling of the polymer-related equipment used in the process. At the same time, reduced routine maintenance (the whole pump can be torn down and reassembled in five minutes) has improved operator morale. Finally, the company notes that the new metering pump has proved so successful that it easily paid for itself after its first 90 days of service.

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