Application Note
Desalter Wash Water & Effluent

Oil & Gas: Refinery

The desalter is one of the first steps in preparing crude oil for distillation. As the name implies, the main purpose of the desalter is to remove salt impurities from the crude. Common salts found in crude oil include MgCl, CaCl, and NaCl. If left entrained in the oils, these salts cause corrosion issues, clogging of downstream piping, and problems with end product quality. The desalter also serves to separate out solids such as sand, drilling mud and paraffin waxes. Proper management of the desalter through chemical addition and pH control influences all other stages in the refinery. This paper will look at the challenges of this measurement.

Electrostatic Desalting Process

As the crude oil is pumped to the desalter it is pre-heated and mixed with 3 - 9% wash water. The wash water's function is to dissolve the salts in the oil. A mix valve upstream of the desalter is used to create an emulsion of the two liquids. Retention time, temperature, mixing efficiency and pH all factor into how much crude oil can be processed. Inside the desalter the wash water and crude oil begin to separate out. Large electrically charged plates cause the water molecules to attract each other, coalesce and form droplets. These droplet fall to the bottom of the tank aiding the separation time. The treated oil is pumped off the top of the vessel while the effluent water is pumped off the bottom to waste treatment. Often the refinery will have a 2nd stage desalter to remove any residual salts from the dehydrated crude oil.

Measurement challenges

pH is typically measured on the wash water leading into the desalter as well as on the brine effluent. The wash water is acidified using commodity acids such as sulfuric, acetic, or citric acid. The type of acid is dependent on the chemical profile of the crude oil. Typical wash water values are 5.5 to 7.0 pH. The wash water is often recycled from other processes in refinery thus it may contain ammonia or phenols. The water is pre-heated to 100 to 150°C. The combination of high temperatures and chemicals can be tough on the pH sensor.

pH measurement on the brine effluent is even more difficult. After the desalter, the water now contains a blend of salts, sulfides, heavy metals, and oil. Particulate material (mud) that settled out in the desalter can also abrade and coat the electrode. pH can fluctuate depending on the crude oil source and the pre-treatment used in extraction and transport. Since the effluent water will be sent to the wastewater treatment plant pH will be measured to determine the treatment regime.

Desalter Process

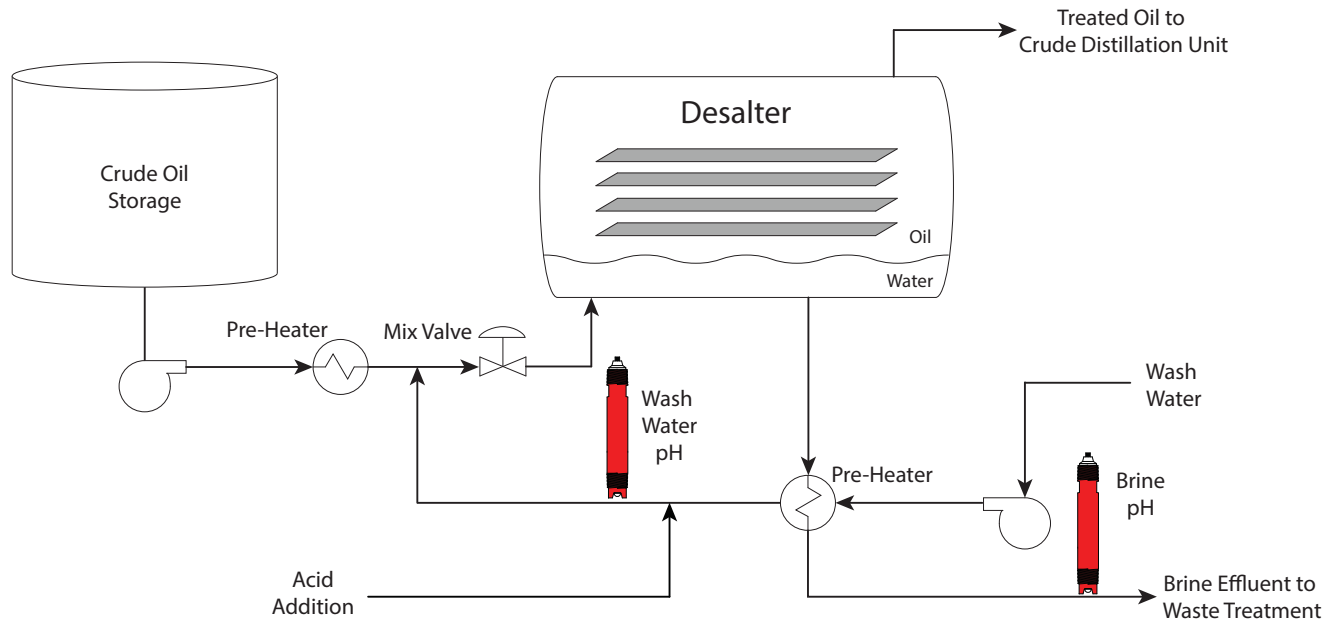

Figure 1

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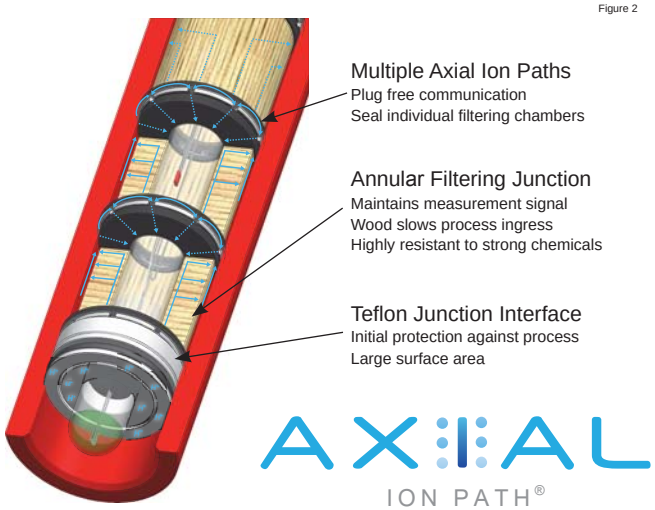
The Solution

Barben Analytical Performance Series pH sensors offer an ideal design for refinery pH measurement. Most issues with pH measurement in these applications are due to reference failure. High sulfides and heavy metals from the crude oil can attack the Ag/AgCl element in the reference. These same oils can plug up the reference junction increasing impedance and creating a noisy measurement.

The Barben Axial Ion Path® reference technology works extremely well to solve these issues. The filtering design of the reference keeps process chemicals away from the Ag/AgCl element while still maintaining a strong signal path.

Figure 2



Barben sensors should be specified with “R” or “CR” high temperature glass electrodes for these applications. Kynar (PVDF) should be specified as the sensor body material due to it’s chemical compatibility and integrity at elevated temperatures.

The maximum temperature rating of these sensors is 130°C (266°F), which provides an opportunity to install the measurement directly into the process through a retractable “hot tap” sensor such as the 547.

Sensors in these applications after often mounted on sample line installations. The Barben 551 Quick Change sensor with flow cell provides an easy way to install and remove the sensor.

547 Retractable “Hot Tap” Sensors

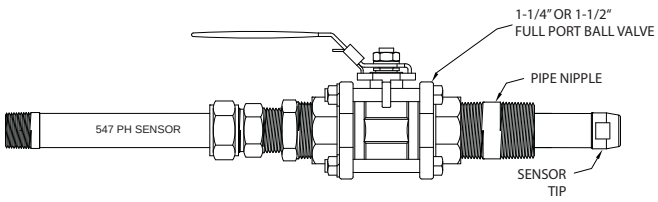


Figure 3

551 Quick Change Sensors

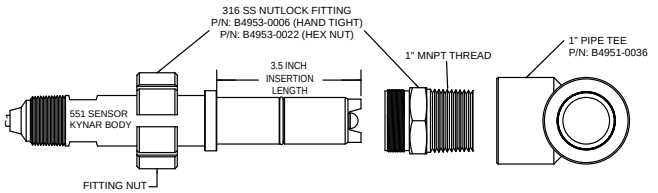


Figure 4

Barben pH sensors will easily connect to most modern pH analyzers in use today, Wiring diagrams for commonly available instruments can be found on www.BarbenAnalytical.com or via request from technical support.

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