ABB MEASUREMENT & ANALYTICS | APPLICATION DESCRIPTION

pH/ORP measurement
Sour water stripping tower

Measurement made easy

Oil and gas sour water stripping tower

Introduction

Refineries classify sour water as any water that contains sulfur compounds. Sour crude oil processed by a refinery liberates hydrogen sulfide (H_2S) during various processing steps. When H_2S dissolves in water, sour water is the result. Since sulfur is the main element in sulfuric acid, sour water tends to be acidic, causing corrosion problems within the refinery's pipework.

Sour water may also contain other contaminants including ammonia, phenols and even cyanide. The quench tower, fluid catalytic cracking unit (FCCU), steam cracking units and any of the distillation columns can all produce sour water within a refinery. Removal of the hydrogen sulfide and ammonia involves converting these compounds back to a gaseous form. The ideal pH for stripping hydrogen sulfide is less than 5.5. Ammonia removal requires a higher pH and is best stripped at pH values greater than 10. Because of this difference, some refineries use two stripper columns to handle each contaminant. If the refinery chooses to use a single stripper column, as in the diagram on page 2, a controlled pH of 8 is generally acceptable to remove both chemicals.

Sour water stripper

In the first stage of the stripping process, called degasification, the sour water is pumped into a flash drum to remove residual hydrocarbons. Hydrocarbon gases usually return to the Sulfur Recovery Unit (SRU) for additional processing.

From the flash drum the sour water goes to a stabilization tank. The purpose of this step is to increase residence time, further separating any leftover liquid hydrocarbons and solids while slowing the flowrate into the stripper. From the stabilization tank, the degassed sour water passes through a heat exchanger for preheating prior to entering the stripper column.

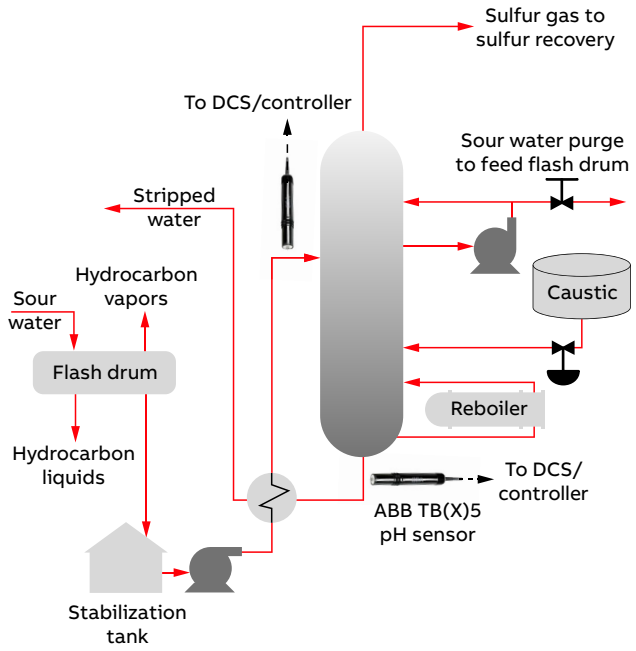
Steam entering the lower part of the stripper column partially originates from condensate that has collected at the bottom of the column; this is passed through a reboiler before being injected back into the column. As the steam mingles with the sour water it removes any dissolved gases.

The steam, together with gaseous ammonia and H_2S, flows from the top of the stripper column back to the SRU for additional processing. The newly stripped water is either used to produce steam in the reboiler or is pumped off to the waste treatment plant or desalter for additional processing.

Measurement challenges

pH control is essential to the effective processing of both H_2S and ammonia. A refinery often injects caustic into the stripper column to help maintain correct pH values. Some refineries measure the pH leading into the stripper, but the high concentrations of hydrogen sulfide and ammonia make this a maintenance intensive application. Most refineries make the pH measurement on the stripped-water line coming from the bottom of the stripper, as indicated.

Column temperatures of 82 °C (180 °F) mean this a high temperature application. Trace amounts of sulfides, ammonia and cyanides may also collect at the pH measurement point. These chemicals poison pH sensor reference junctions by reacting with the silver ions present.

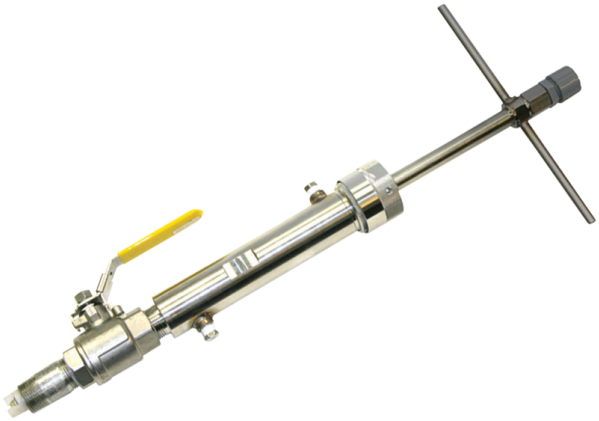


The ABB solution – TB(X)5 pH sensors

ABB recommends that pH is measured on the condensate collected from the bottom of the stripper column. Pressures at this point are typically less than 20 psig (1.3 bar) but, because of the high temperatures, ABB recommends that this pH measurement be made on a conditioned sample line or fast loop. ABB's Next Step Wood Reference is the best solution to the problem of reference poisoning by sulfide and ammonia attack; the TB(X)5 sensors have double or even triple the lifespan of conventional double-junction gel filled pH sensors. The ABB coat-resistant 'J' glass electrode is the preferred measurement electrode style. These measurements often take place in hazardous areas; suitable instruments include the ABB TB82PH transmitter with intrinsic safety barriers or the new APA592 Endura transmitter with Exd housing.

The TB(X)551 sensor uses a twist lock bayonet mounting style for use in sample lines

New APA592 Endura transmitter with Exd housing

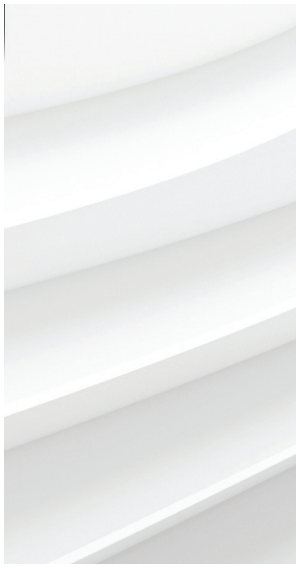


The TB(X)587 is ideal for retractable installations up to 150 psig (10 bar)

ABB Limited
Measurement & Analytics
Oldends Lane
Stonehouse
Gloucestershire GL10 3TA
UK
Tel: +44 (0)1453 826 661
Fax: +44 (0)1453 829 671
Email: instrumentation@gb.abb.com

ABB Inc.
Measurement & Analytics
125 E. County Line Road
Warminster, PA 18974
USA
Tel: +1 215 674 6000
Fax: +1 215 674 7183

abb.com/measurement



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