APPLICATION NOTE

Measurement of Pulp Stock to the Blow Tank

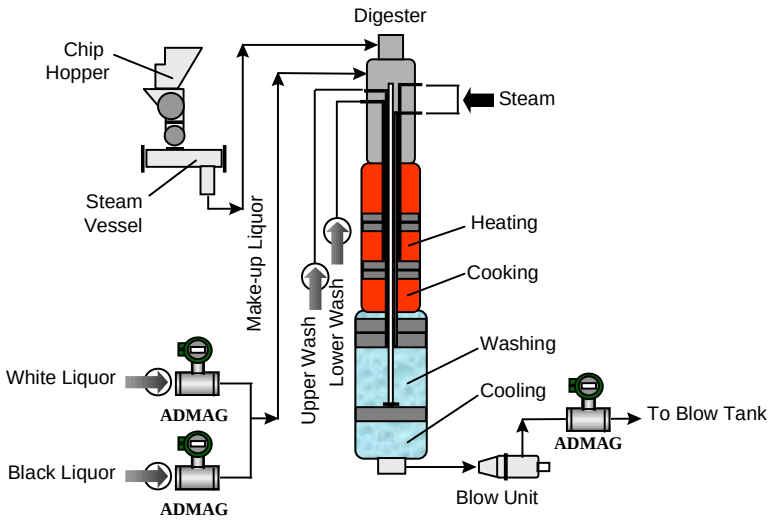
INTRODUCTION

The pulp and paper industry holds some of the most aggressive and challenging applications for magmeters. There are corrosive chemicals, high temperatures and pressures, and abrasive slurries. One application which is particularly difficult is the measurement of pulp stock from the digester to the blow tank. Yokogawa can provide one of the most reliable and accurate meters for this application.

APPLICATION

In the paper making process pulp is produced by placing wood chips into a digester where it is cooked under high pressures and temperatures in a caustic solution. This caustic solution, termed white liquor, removes the lignin binding the cellulose fibers together in the wood. Spent cooking solution, or black liquor, may be added to the white liquor to maintain a completely full digester. The mixture of wood and liquor is steam heated to begin the “cook”. The wood chips are reduced to a mush-like consistency and the cooked pulp is then washed, diluted and cooled using a weak liquor. The pulp is then ready to be transported to the blow tank. The pulp is discharged from the bottom of the digester using a blow-unit through the blow valve and into the blow tank.

The blow valve at the bottom of the digester that regulates the flow of the pulp stock from the digester to the blow tank is controlled by the use of a magnetic flow meter. By accurately measuring and controlling the amount of pulp stock out of the digester, a pulp and paper mill can



(1) obtain higher yields
(2) reduce chemical usage
(3) increase throughput
(4) produce a more uniform product

Conventional style magnetic flow meters have difficulties in measuring the pulp stock due to problems related to exposed electrode seals and liner abrasion which results in a short life expectancy. In addition, slurry noise can produce an unstable output with resulting loss of accuracy and control.

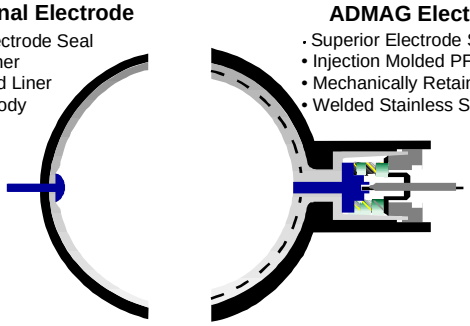
SOLUTION

The design of the ADMAG magnetic flowmeter makes it an ideal meter for use in the high temperatures and abrasive conditions seen in a digester blow line.

Competitor’s meters are likely to fail due to the electrode design and other considerations. As shown in the figure below, competitor’s designs have an exposed electrode seal which is prone to failure because abrasive flows can easily wear away the sealing area and cause the meter to leak. The ADMAG has no exposed seal to fail, resulting in better reliability and uptime. This design not only removes the sealing surface of the electrode from the process, the flush electrode design reduces the slurry noise due to wood/pulp particles colliding with the electrode.

Conventional Electrode
- Exposed Electrode Seal
- Extruded Liner
- UN-Retained Liner
- Aluminum body

ADMAG Electrode
- Superior Electrode Seal
- Injection Molded PFA
- Mechanically Retained Liner
- Welded Stainless Steel body



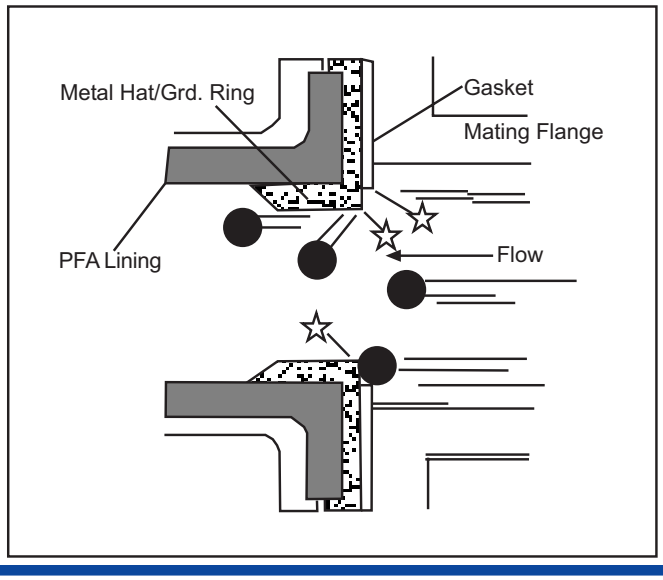
In slurries, such as pulp stock, noise is generated when solid substances collide with the electrode. In general, the electrode is covered with a thin oxide film and the solids hit the electrode, breaking the oxide film and exposing the metal. Electronic noise then occurs when the exposed metal tries to stabilize by re-oxidation. This slurry noise has its highest amplitude at low frequencies, so conventional meters using low frequency DC excitation (7.5 Hz) can suffer from slurry noise. High frequency AC meters using 60 to 65 Hz excitation do a good job of reducing slurry noise because of high frequency sampling, but have problems with zero stability and in turn poor accuracy (the accuracy of a typical AC meter is 1% of span). ADMAG's dual frequency excitation has the advantages of both the high and low frequency meters. Dual frequency excitation provides fast response time (0.1 second), good zero stability, accuracy of 0.5% of reading and immunity to slurry noise.

Non-retained liners (extruded liner), which are commonly used in conventional meters, are susceptible to failure as a result of the abrasive pulp stock. The pulp slurry can erode the liner, causing the flowtube to fail. The extruded PTFE liners used in conventional meters are typically thinner than the PFA liner used in the Yokogawa ADMAG Series of flow tubes. Yokogawa uses an injection molded PFA liner with a retaining grid. This rugged construction holds the liner in place and prevents the pulp stock from penetrating the liner and coming into contact with the internal stainless steel tube. The thickness and durability of the injection molded PFA liner provides a flow tube that is capable of handling the most severe applications.

NOTES

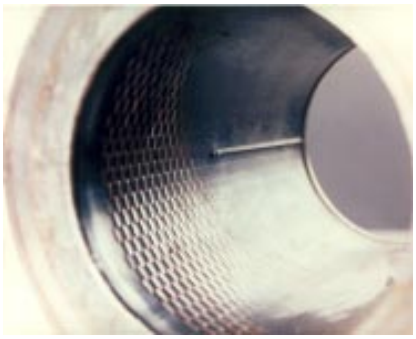
1. The use of platinum electrodes instead of stainless steel can further improve the immunity to slurry noise. Platinum is a harder material and in addition has excellent anti-oxidation characteristics. Output fluctuations can be reduced 1/3 to 1/10 that of stainless steel.
2. The life of the flow tube can be extended by the use of a metal hat (see figure below). The metal hat protects the leading edge of the flow tube by covering the front leading edge of the lining.

The power of Yokogawa's dual frequency excitation combined with the advanced design of the flowtube ensures an accurate and reliable means of measuring pulp stock fluids.



- ❒ Molded, mechanically retained PFA liner!
- ❒ Flush electrode design!
- ❒ No exposed electrode seal!
- ❒ Dual-frequency excitation!
- ❒ Excellent slurry performance!

Admag lasted more than 5 years in a digester blow line where other meters lasted 6 months.



Enlarged view of meter above illustrating worn liner mechanically retained by bridge-plate.

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