

ABB Analytical – Conductivity Measurement of Residual Pulp Stock Chemicals

Industry: Pulp & Paper

Safe-T-Clean® Valve Improves Conductivity Measurement in Pulp Stock

ABB Instrumentation and a fine paper kraft mill in the northeastern United States worked closely together to solve a difficult conductivity measurement in 12% bleached pulp stock slurry.

The conductivity measurement utilizes ABB's patented four-electrode sensor technology along with the versatile TB18 Safe-T-Clean® valve. The sensor is wired to an ABB TB82EC transmitter which provides a local display and fully programmable analog current output. The conductivity measurement is important to the mill as it monitors salt and other chemicals that accumulate in the pulp as a result of improper washing and chemical addition. Chemical carryover in the pulp mill has adverse effects on papermaking. Conductivity measurement allows the mill to take preventative action to overcome the residual chemical buildup in the pulp. The mill now finds this difficult conductivity measurement to be very stable and accurate and estimates **savings of over \$1 Million dollars per year** in machine chemicals. These savings were derived from adjustment to the pulping and bleaching process to minimize salt carryover to the paper mill. This astonishing success was not achieved without some difficulties along the way.

Sensor Location and Installation is Key to Measurement Success

All pH and conductivity sensors take advantage of the dewatering effect that occurs as pulp flows in a pipeline. If the flow is laminar, a narrow band of water forms on the inside edge of the pipe. It is in this area that the sensor should be located. If the flow is turbulent, the dewatering affect will not take place and a stable measurement cannot be achieved. As a result, specific guidelines have been formulated for locating sensors in pulp stock. These guidelines include mounting the sensor in either a horizontal or vertical flowing line, inserting the sensor at 90° angle to the stock flow, and only inserting the sensor ¼ inch (6mm) into the pipeline.

The original installation involved using an ABB TB461 ball valve insertion style sensor. See Figure 1. Thousands of installations have shown linear insertion style sensors to be an accurate and reliable way to make the conductivity measurement.

Unfortunately the initial installation of the sensor was in a gravity fed, downward flow pipeline following the pulp washer. Pulp stock coming off this washer falls by gravity in clumps. The flow is erratic and no dewatering of the pulp takes place. The resulting conductivity measurement was noisy and unstable.



Figure 1: Unsuccessful installation using a traditional insertion sensor mounted in a down flow pipe.



Figure 2: Close up of the TB18 valve welded on the up-flow 12% consistency stockline

A new sensor installation point was needed. A downstream location on the discharge side of the thick stock pump was approved.

Unfortunately the pressure on the discharge side of the pump was 225 PSIG (15 BAR), which posed safety concerns and exceeded the maximum rating for most traditional insertion style conductivity sensors. An answer was found in the Model TB18 Safe-T-Clean and flush faced four-electrode conductivity sensor Model TB464. This valve can be used with this sensor up to 300 PSIG (20 BAR). A location in a vertical pipeline approximately 20 foot (6M) from the pump was chosen. It is shown welded flush to the side of the pipe in Figure 2.

The TB18 Safe-T-Clean valve has been used extensively in pulp and paper pH, ORP and conductivity measurements for many years. Instead of a linear motion, the Safe-T-Clean valve relies on a rotary motion to expose the sensor to the pulp. This unique design allows the sensor to be inserted into a process line or vessel without exposing plant personnel to the process environment. Once rotated into the process, the sensor can be manually screwed in the pulp stock exactly 1/2 inch (12mm) past the face of the valve. This guarantees a fresh continuous sample passes the face of the sensor. It also guarantees that the sensor sees the same consistency and amount of liquid every time it is installed.

Installing the conductivity sensor to the same depth is important for accurate and stable measurements. Traditional linear insertion sensors require great care to ensure the sensor is inserted to the same depth within the pipe every time. The Safe-T-Clean valve guarantees the same sensor installation depth by using a mechanical stop. The TB18 valve can also be fitted with an valve actuator for automatic rotation in and out of the process. Once rotated out of the process the sensor can be automatically flushed, cleaned or even calibrated.

Summary and Results

After relocating the conductivity measurement to a vertical pipe using the Safe-T-Clean valve downstream from the stock pump the conductivity measurement stabilized and showed excellent correlation with lab samples.

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The mill now has a continuous, reliable on-line measurement of pulp stock quality. Figures 3 & 4 shows the new trend of the conductivity reading and the drops after the peaks show the results of corrective action to the high salt concentrations. As a previously said the mill expects to **save over \$1 Million dollars per year in paper stock preparation and paper machine chemicals** as they adjust the pulping and bleaching process to minimize salt carryover from the pulp mill.

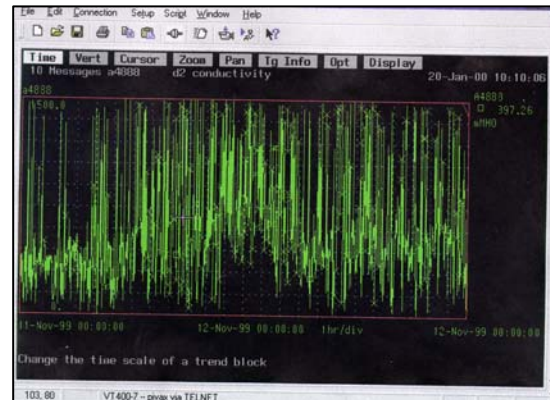


Figure 3: Trend of initial conductivity measurement with sensor location on the suction side of a pump in a down flow line.

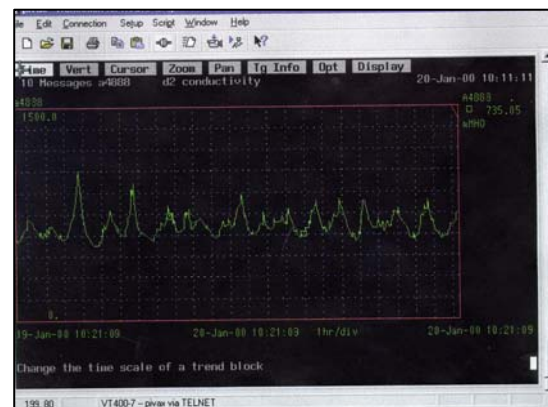


Figure 4: Trend of the conductivity measurement after installation of the TB464 sensor in the TB18 Safe-T-Clean valve 22 feet after the discharge side of the stock pump.