High Chemi washer process variability limits the production rate and compromises washer efficiency.

Chemi Washer Performance Objectives:

- High Production Rates
- High Black Liquor Solids
- Good Stock Quality/ Low Conductivity

Factors affecting Washer Performance:

- Stock Property Variability
  - fiber type
  - Kappa
  - freeness
- Process Control Variability
  - Production rate
    - Stock flow
    - Stock consistency
  - Washer Vacuums & Levels
  - Dilution water flow, Dilution factor
  - Defoamer

Survey Objectives
Optimize:

- Operating Efficiency
- Washer Production Rate
- Stock Quality/Conductivity
- Black Liquor Solids

Survey Procedure:

- High-speed process data collection
- Data analysis
- Diagnose variability sources
- Bump testing
  - Identify variability source
  - Determine process dynamics
  - Identify equipment problems
- Improve Control Performance
  - Retune controllers
  - Implement tuning strategies
- Recommend Process Improvements

ProNamics chemi washer optimization surveys have resulted in significant production increases while maintaining black liquor and stock quality targets.

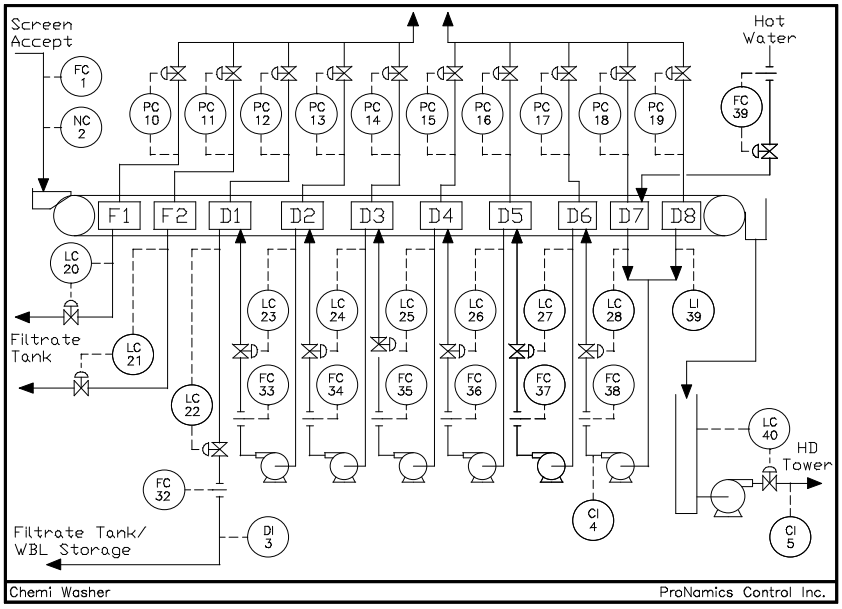
Stock Properties:

In-coming stock properties such as fiber type, Kappa, freeness are important contributors to chemi washer performance. These variables will affect sheet formation, drainage, foaming and other factors.

Process Control:

Important process variables under automatic control include:

- Production rate
  - Stock flow
  - consistency
- Washer Vacuums & Levels
- Dilution water flow, Dilution factor
- Defoamer



Variability in the washer controls generates variations in sheet basis weight and filtrate loading.

Typical sources of control variability in the washer are:

- Control loop interaction
- Oscillatory controller tuning
- Poor control performance (slow)
- Control valve and sensor issues

The vacuum and level controls in the displacement zones are interactive and if not setup correctly will cause vacuum, level and filtrate flow cycling. The interaction can easily be eliminated by implementing a tuning strategy.

Production Rate Variability:

Control of the mass stock flow to the washer in critically important. Production rate variability causes variations in sheet properties affecting the filtrate flow through the sheet. This results in stock conductivity and black liquor solids variations limiting the production rate.

The primary sources of mass stock flow variability to the washer are:

- Poor HD chest consistency control performance
- Poor chest consistency control performance
- Poor chest mixing
- Dilution water flow/pressure variability
- Control valve or sensor issues
- Oscillatory tuning

Fig. 1 shows high feed consistency variability. Reducing this variability by improving consistency control performance allowed a production rate increase of 1.6% or 9TPD while maintaining stock outlet conductivity and black liquor solids at target. This production rate increase was equivalent to $2700/D ($945,000 annually).

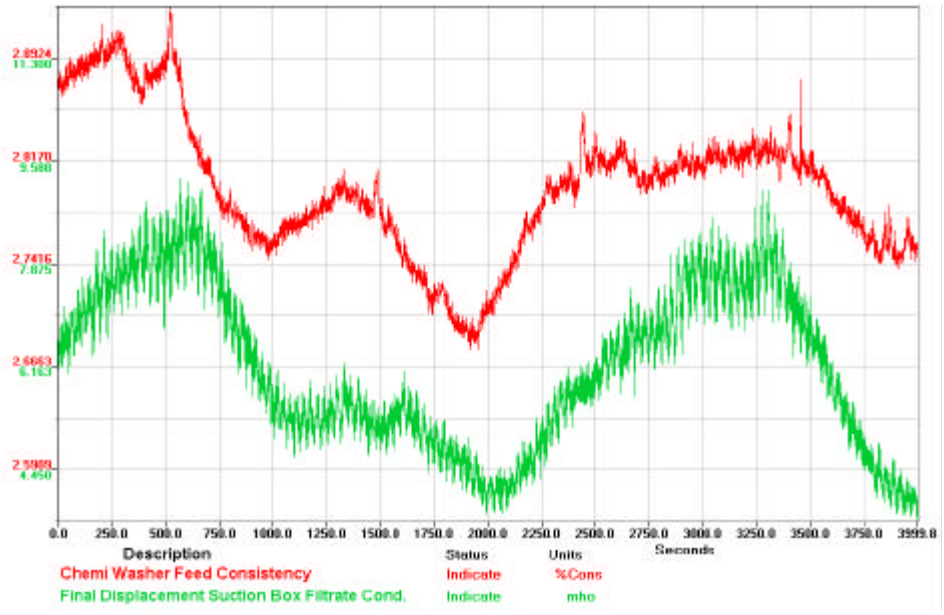


Fig. 1 Consistency variability, due to poor consistency control performance, was resulting in liquor (and stock) conductivity variability limiting washer throughput.

Suction Box Vacuum/filtrate flow Variability

Good washer vacuum control performance is a critical factor to washer performance. Hi vacuum variability reduces liquor flow through the sheet/ wire and therefore limits the washer production rate.

At upper production rates vacuum variability will result in the following, ultimately reducing washer production rate.

- Reduced liquor flow through the sheet/wire
- Liquor carry over to downstream suction box
- Filtrate flow between suction boxes limited
- High suction box levels/level control limited
- Low liquor solids
- High outlet conductivity

The primary sources of vacuum variability are as follows:

- Stock feed flow and/or consistency variability
- Oscillatory vacuum & level control
  - Oscillatory controller tuning
  - Control valve or sensor issues
- Foaming
- Suction box leaks

Fig. 1 shows high #2 formation and #1 and #2 displacement vacuum variability. Reducing this variability by improving the vacuum controller tuning allowed a production rate increase of 4% or 20 TPD while maintaining stock outlet conductivity and black liquor solids at target. This production rate increase was equivalent to $6000/D ($2,100,000 annually).

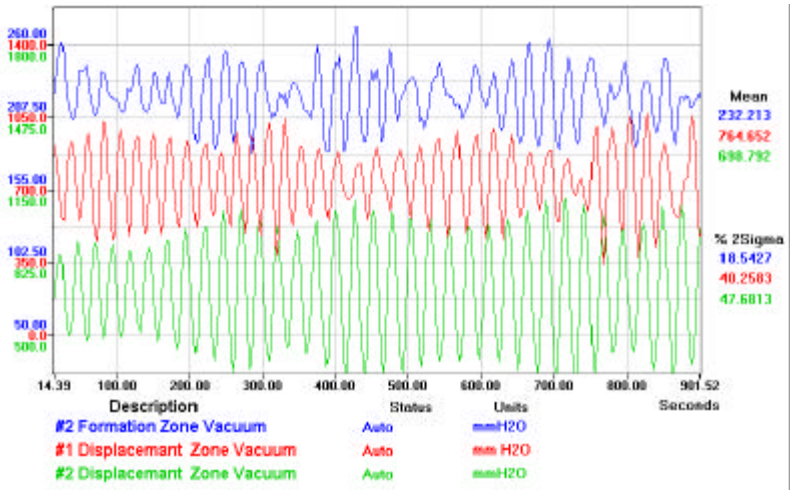


Fig. 2 #2 formation and #1 displacement zone vacuum cycling is causing excess liquor carry over to the #2 displacement zone and reduced liquor solids.

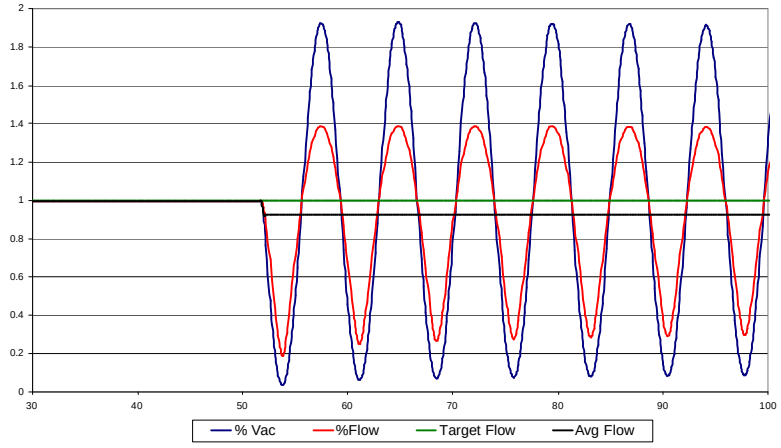


Fig. 3 Filtrate flow through the sheet/wire is a square function of the vacuum. Vacuum cycling reduces the filtrate flow through the sheet/wire.

ProNamics Control Inc. Chemi Washer Process Optimization Survey

The objective of a ProNamics Chemi Washer process optimization survey is to *increase operational efficiency in order to increase washer production, increase black liquor solids and improve product quality*. These objectives will be achieved by reducing process variability in the key process variables. A ProNamics Control Inc. chemi washer optimization survey will provide a clear path forward for achieving these objectives.

High-speed data acquisition equipment is used to collect process data directly from the control systems I/O. Time series analysis tools such as the power spectrum and cross correlation are applied to assist in diagnosing variability problems Coupling tests are conducted to quantify the impact of the source on product quality. Many open loop bump tests are conducted to define the loop process dynamics and provide insight into control valve and loop design problems. Controllers are retuned and tuning strategies implemented where appropriate to improve process stability.

The professionals at ProNamics have been conducting process optimization surveys in the pulp and paper industry for many years. Their extensive knowledge of pulp and paper processes, process equipment, control strategy alternatives, control loop health and process simulation techniques allow them to focus on the priority problem areas, implement improvements and develop authoritative recommendations.

ProNamics Control Inc.
PO Box 2714
Squamish, BC
Canada, V0N 3G0

Phone:(604) 898-1376
Fax: (604) 898-1378

www.pronamicscontrol.com
sales@pronamicscontrol.com