Campaign 1
Problems & Resolutions

UF Stan Mayfield Biorefinery Pilot Plant

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I. Pretreatment Discharge Valves

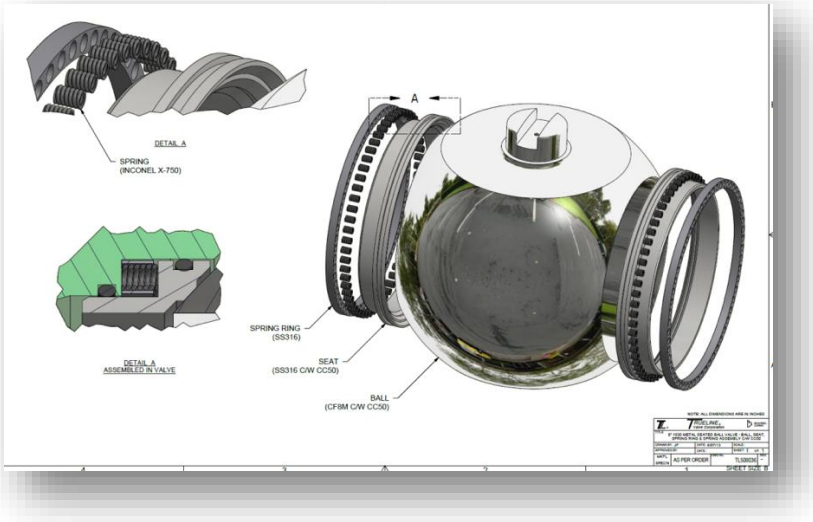
Problem

Prior to Campaign 1, the original ball valves specified for the discharge of the pretreatment system kept fouling and leaking. The sugarcane bagasse was badly scoring the metal surface of the balls and seats.

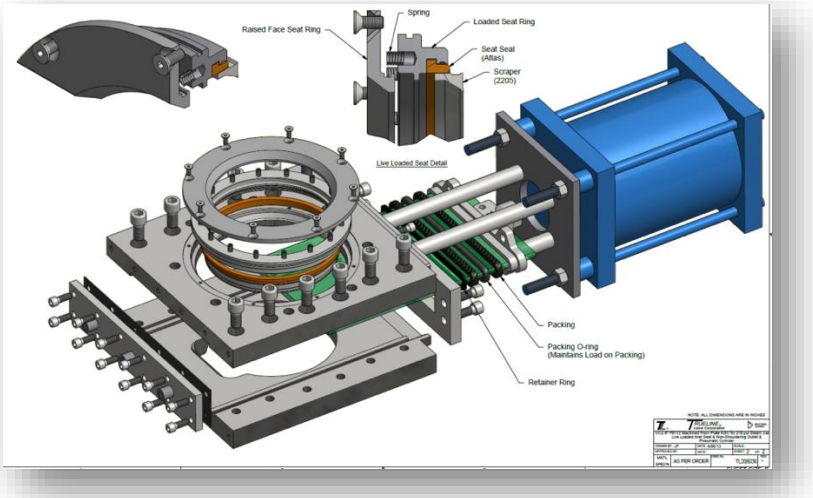
Resolution

We went two routes to be safe:

1. We hardened the metal of the original ball valves.



2. We ordered two new high temp/high pressure knife gate valves to test. The knife-gates arrived before the hardened ball valves, and they performed much better.



Status

Resolved. We will use the knife gates for the first four Campaigns at the least. Testing of ball valves will happen at some point in time.

II. Pretreatment Knife Gate Insertion Space

Problem

Prior to Campaign 1, the knife gate insertion spaces were frequently clogging with biomass. This led to an incomplete gate closure which allowed for steam leakage.

Resolution

A purging system which blasts air/water through the spaces during each cycle.

Status

Resolved, but clogging is still an issue after extended periods of operation.

III. Plug Screw

Problem

Prior to Campaign 1, the plug screw, which holds back pressure at the inlet of our pretreatment system, wore prematurely. This was due partly to a high blow back dampner pressure setting (60 psi), but more so to the lack of hardening on the screw surface. The evidence of wear came from several random incidents of a lost plug and system depressurization. In the picture below, wear can be seen from the rounded edge on the flight.

Resolution

Stellite hardening of the plug screw.

Status

Resolved.

IV. C5 Hydrolysate

Problem

Prior to Campaign 1, the C5 tank which collects hydrolysate from the screw press was maintaining the hydrolsate at a high temp, which allowed for further degradation and increased toxicity.

Resolution

We took the insulation off the tank and fabricated a shell and tube heat exchanger. The fabrication took some time, so in the meanwhile we kept the hydrolysate cool by diverting it to 300-gallon plastic totes. The heat exchanger was first used in Campaign 3. In the picture below, the heat exchanger is wrapped in black insulation.

Status

Resolved.

V. Pre-Steam Bin Level

Problem

Prior to Campaign 1, we had trouble maintaining a consistent level in the pre-steam bin. The biomass pile within the bin would form a steep slope via the live bottoms, and then at random the top half of the sloped pile would crumble down. This led to inaccurate level readings. Also, if the bin was overfilled, biomass would get in the way of the cablevey discs and cause the cable to hop off track or severely clog the outlet tube which risked snapping the cable.

Resolution

We found that keeping the level above 50% helped, but level readings would still fluctuate too much. We then designed and fabricated an agitator to help keep the bin at a uniform level.

Status

Resolved.

VI. Boiler Water Level

Problem

Immediately prior to Campaign 1, the boiler turned off due to a low-level alarm. The level control had stopped working.

Resolution

The issue was due to dirty conductivity level sensing probes. We carefully took them out and cleaned them with CLR.

Status

Resolved.

VII. Pumping from the Bottom of the Liquefaction & the pH Adjustment Tank

Problem

During Campaign 1, we had great difficulty pumping from the bottom of the liquefaction and pH adjustment tank. Loadsure elements within our peristaltic pumps kept rupturing. Most of the trouble arose once the level in the tank started getting low. We eventually drained the remaining contents to the floor, which is when we discovered that rocks were the main reason for clogging.

Resolution

We decided that pumping from the side of the tank rather than the bottom should help. We planned to incorporate new lines for both tanks which would come from the sample port. We also planned to install a “rock trap” to remove rocks that make their way out the side port. This plan would not be complete until after Campaign 2, before Campaign 3.

Status

Resolved.

VIII. Transfer Lines

Problem

During Campaign 1, the transfer lines between liquefaction, pH adjustment, and the fermentor were starting to clog quite frequently. We could prevent a full clog by monitoring the pressure in the line, and then reversing the pump once a clog started. A few times, reversing did not help, and we had to use UV water from the CIP header to break the clog.

Resolution

The clogging was primarily due to a low flow rate of slurry, which is unfortunately unavoidable for our operation. In preparation of a case where a clog is so bad, we cannot clear it quickly during operation, we ordered long lengths of high pressure/high temp ultra-chem hosing with cam-lock fittings. This could be used to re-route the slurry and continue operation.

Status

Resolved. The lengths of hosing ended up helping in many ways.

IX. Feed System

Problem

During Campaign 1, the chute at the bottom of the feed bin live bottom collecting conveyor was clogging frequently. This clogging caused temporary stops in our feeding, lasting up to 20 minutes. Several times we had to completely shut down pretreatment because the pre-steam bin level became too low.

Resolution

We incorporated an air purge system which blasts air continuously through the chute.

Status

Resolved. This has helped tremendously.

X. Sampling Procedure

Problem

During the Campaign, there was some slight confusion on when and how samples should be taken throughout the Campaign.

Resolution

A better procedure with printed out charts for a streamlining.

Status

Resolved.

XI. CIP Rinse Cycle After Campaign

Problem

After the Campaign, we discovered that the CIP filters could not handle the rinsate from the first step of CIP for the liquefaction, pH adjustment, and fermentor tanks. The residual slurry on the inner walls of the tanks was too much.

Resolution

A new procedure to be implemented during the first step of CIP: drain all rinsate directly to the floor for the respective tanks.

Status

Resolved.