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HIGH EFFICIENCY CONTINUOUS CENTRIFUGALS USED IN "A" MASSECUITE
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By

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San Cristobal Mill "A" continuous centrifuges

ABSTRACT

The use of high performance, high throughput continuous centrifuges is a viable option to process "A" massecuite and then re-melt the sugar in the centrifuge to feed a refinery, as successfully demonstrated at the San Cristobal Mill in Mexico. This was accomplished by adding new engineered components to standard design continuous centrifuges enabling 5 specially equipped machines to successfully replace a larger battery of 26 older batch centrifuges. The quality of the sugar produced was equal to that produced by the batch centrifuges while at the same time operations were simplified considerably. Since continuous centrifuges are inherently less complicated with fewer moving parts and are less expensive to operate and maintain, sugar mills can expect significant reductions in initial investment and on-going operational expenses.

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INTRODUCTION

The San Cristobal Mill in Veracruz, Mexico, driven by the need to reduce operating expenses and simplify operations, approved a project in 2010 to replace26 old batch centrifuges that were processing “A” massecuite*. The management of San Cristobal decided to take a step forward by designing an innovative system to employ continuous centrifuges to feed its refinery with “A” sugar re-melt. The mill and the refinery are located adjacent to one another allowing the re-melt sugar to be gravity fed by pipe from the mill to the refinery without any affination step required. San Cristobal’s management, after evaluating all major centrifuge manufacturers, selected The Western States Machine Company to supply 6 midsize Titan 1300 continuous centrifuges (5 in operation and 1 in stand-by). The project required a minimum throughput process capacity of 200 MT/Hour of “A” massecuite under very strict process conditions as listed in Table 1.Western States provided a written guarantee that each Titan 1300wouldprocessa minimum of 40 MT/Hour of “A” massecuite

* Note: The option to modernize instead of replace the older batch centrifuges was considered, however in this case due to their age and condition it was found not to be economically attractive.

PERFORMANCE REQUIREMENTS AND PROCESS CONDITIONS

In order for the project to be considered successful, San Cristobal established performance parameters from the beginning. Table 1 below contains the performance criteria mandated as well as the process conditions established for the project.

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TABLE1. Performance parameters and process conditions

Performance Parameters	
Minimum capacity for battery:	200MT/Hour(“A” massecuite)
Minimum capacity per Titan 1300 CC	40 MT/Hour(“A” massecuite)
Minimum sugar purity	99.0
Maximum sugar color	ICUMSA 600
Minimum brix of “A” sugar re-melt	65
Process conditions of massecuite	
Brix	91-92
Purity	88-89
Temperature	54-56 degrees C

CONTINUOUS CENTRIFUGE CONFIGURATIONS

Western States mechanical design is used interchangeably for “A”, “B” or “C” massecuite configurations (see Figures 1-4) without a need for a special “A” basket design. All configurations have options for re-melt (wet) discharge and molasses separation (see Figure 1). The key component is the high performance, one-piece solid cast basket design capable of processing 40-60 MT/Hour of “A” massecuite (sugar of maximum ICUMSA 600 color). The high throughput basket with maximum open area of 7.26% and deep wall molasses channels provides the fastest separation and most efficient design in the industry. These features enabled each centrifuge to meet the operating parameters required for this project. The feed and drive systems remain basically the same except for the addition of a Variable Frequency Drive. However, filter screens have different open areas according to the type of massecuite to be processed.

Additional components engineered for “A” sugar re-melt include the following:

- A new re-melt curb design incorporates a stainless steel shelf to increase the retention time of the sugar and enhance the mixing process (see Figure 1).

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- A specially designed spray ring for “A” sugar re-melt is incorporated into the curb design (see Figure 1).
- The location of the special modular design, high-temperature water and steam control panel allows easy access and control by the operator (see Figure 2).
- Additional basket water and steam piping are incorporated to improve sugar wall wash (see Figure 3).
- Special instrumentation includes: sensors to monitor temperature, pressure and vibration, water and steam pressure regulators, filters, flow meters and proportioning valves. These valves respond to the motor load amperage to control the amount of re-melt and rod water.
- A Variable Frequency Drive is used to adjust basket rotational speed to compensate for differences in massecuite quality and process conditions.
- A control cabinet with state of the art PLC and touch screen HMI simplifies the operation and reduces manpower (see Figure 5).
- The control system incorporates automatic and manual modes with built-in diagnostics and alarms.
- The option for remote communications module and integration with plant control systems is available.

In Western States’ experience, sugar obtained from continuous centrifuges is comparable in quality to sugar obtained from batch centrifuges, except for additional crystal breakage and higher moisture content. Since the moisture content measured to date has always been in excess of 0.9 %, it is always advisable to calculate and evaluate the additional drying capacity and energy cost involved in preparation of “A” sugar for final packaging.

RESULTS OBTAINED IN 2011/2012

The data gathered (Table 2 below) during the first campaign of operation met San Cristobal Management’s expectations. Results confirm that it is possible to obtain “A” sugar “re-melt” with the color, brix and purity specified with good molasses exhaustion. During the initial learning process, many adjustments and improvements were identified and incorporated, as one would expect from implementing a new

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process. Changes were made to ensure a smooth flow of re-melt sugar to the refinery and to have an adequate supply of filtered process water within the temperature range specified. Due to these adjustments, projections for the forthcoming 2012/2013 campaign are expected to exceed last year's results.

TABLE 2. "A" sugar battery data from 2011/2012 campaign

- Maximum sugar color: 600 ICUMSA
- Minimum sugar purity: 99.0
- Brix, mixed rich and poor molasses: 75-76
- Purity, mixed molasses: 75-76
- Minimum brix of "A" sugar re-melt: 65
- Titan 1300 measured capacity at 50 % motor load amperage: 39 MT/Hour of massecuite
    - Note 1: Tests were made at 55 % and 60 % of motor load amperage; however it was decided to stay at 50 % to duplicate results obtained.
    - Note 2: Capacity with maximum sugar color of ICUMSA 600 is expected to exceed 50 MT/Hour at higher motor load percentages
    - Note 3: Throughput capacity is conditioned by the sugar color requirements. These need to be established from the beginning to ensure adequate capacity.
- Selected basket rotational speed: 900 RPM (589 G's)
    - Note: Speed can be selected at the control cabinet using the Variable Frequency Drive.
- Lubrication and wash water: 5.0-6.5 GPM (100 degrees C and minimum 60 psig)
- Pre-melt water for 65 Brix: 15-17 GPM (100 degrees C and minimum 60 psig)

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CONCLUSIONS

Results obtained after one campaign met or exceeded all expectations in terms of the performance criteria established for the project. The use of high efficiency, high throughput continuous centrifuges in this application proved to be technically and economically feasible. The outstanding performance of the Titan 1300's in conjunction with process improvements implemented, allowed results to meet or surpass project targets (as shown in Table 2 above).In addition, San Cristobal reported significant savings in the operation, man power and maintenance of the5Western States Titan 1300 continuous centrifuges, compared to the 26 old batch centrifuges replaced. Additional savings were realized in spare parts inventory since they also operate Titan 1300's in "B" and "C" massecuite with many parts in common. Supplementary savings were also realized in training since the operating & maintenance personnel were already familiar with these centrifuges.

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PICTURES

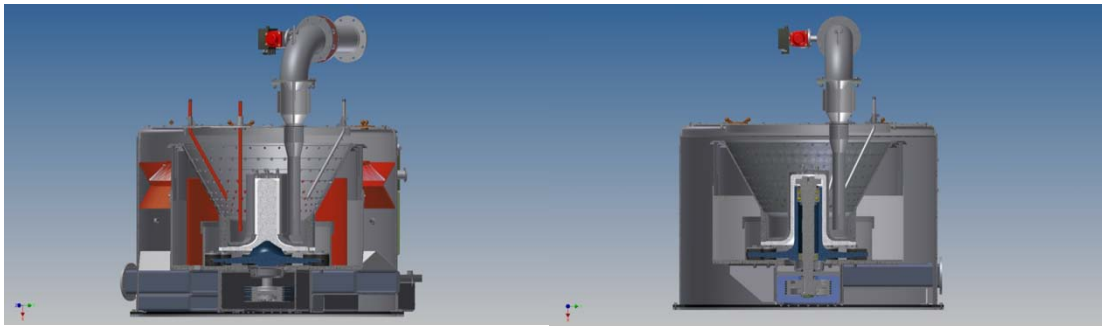

Figure 1. Titan 1300 (cross section view) configured for “A” (left) and “B” or “C” (right) massecuite

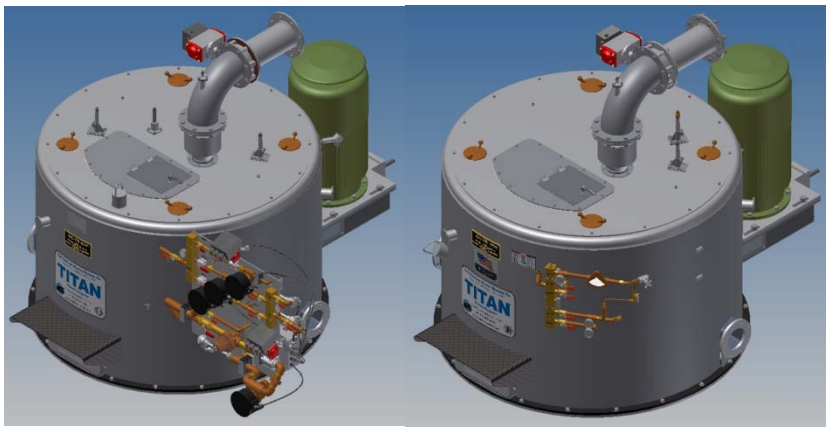

Figure 2. Titan 1300 configured for “A” (left) and “B” or “C” (right) massecuite

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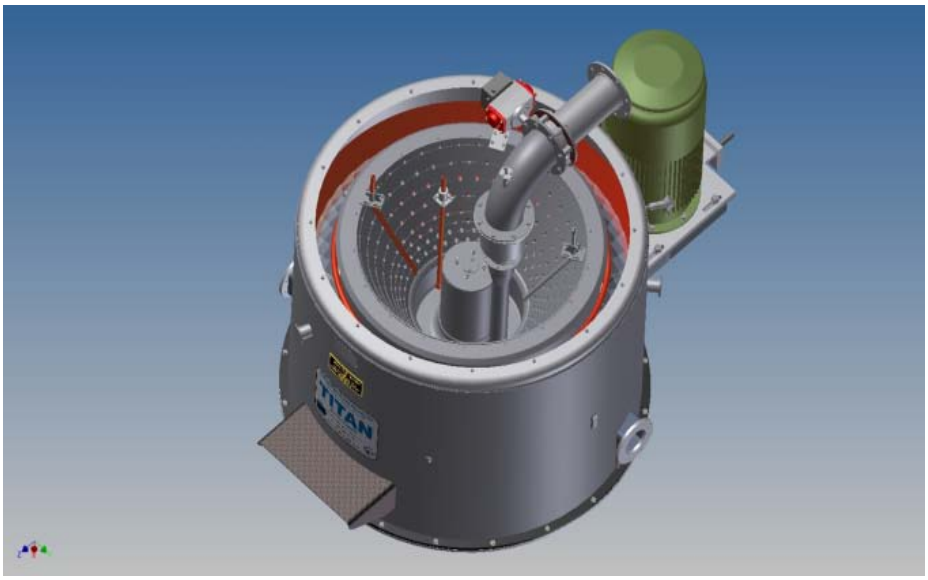

Figure 3. Titan 1300 “A “massecuite configuration top view

Figure 4. Titan 1300 “B” or “C” massecuite configuration

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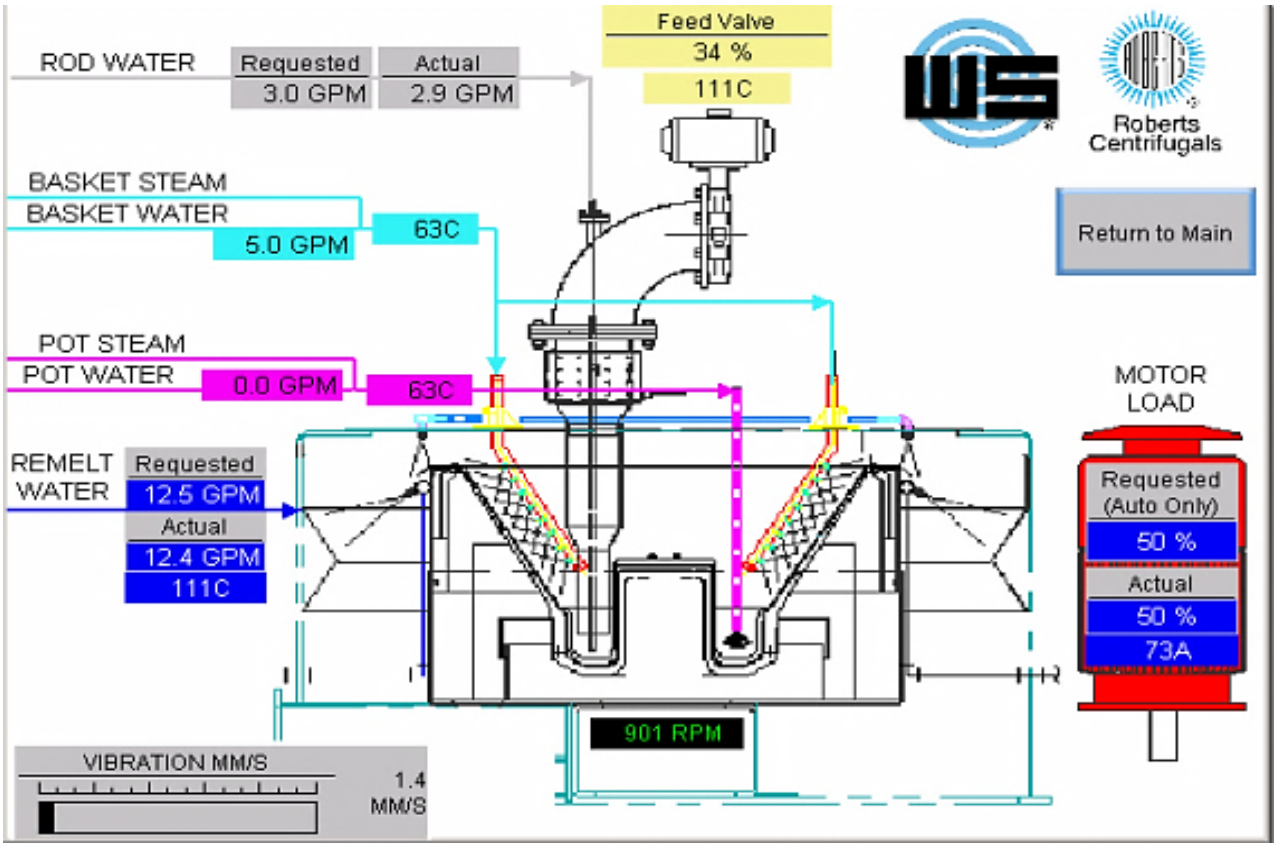

Figure 5. Titan 1300, “A “massecuite configuration. Monitoring HMI screen