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abstract

For many decades, centrifugals have been absolutely vital for sugar production. In the course of time, their design and features have been modified and upgraded many times. Could it therefore be that they have reached the final stage of development? BMA's new batch centrifugal of the E-series is setting an impressive example of how much potential for development an already highly sophisticated product still offers: As before, the sugar is spun to separate the sugar crystals from the mother liquor but the subtle difference is in the detail. This article explains what concrete benefits users will derive from the latest technical and technological insights that have been incorporated into this generation of BMA centrifugals. First practical experience confirms the success that this consistent development has brought.

Keywords: **basket design, batch centrifugals, BMA, discharger, syrup separation**

Centrifugas por lotes: ¿hemos llegado al fin del desarrollo?

Por muchas décadas las centrifugas han sido absolutamente vitales para la producción de azúcar. A lo largo del tiempo su diseño y características han sido modificados y mejorados muchas veces. ¿Puede ser que, en consecuencia, se haya llegado a la etapa final de su desarrollo? La nueva centrifuga por lotes de BMA, de la serie E, establece un impresionante ejemplo de cuanto potencial de desarrollo ofrece aún un producto altamente sofisticado: como anteriormente, el azúcar es girado para separar los cristales de azúcar del licor madre- la diferencia sutil está en el detalle. Este artículo explica qué beneficios concretos obtendrán los usuarios de las últimas inspiraciones técnicas y tecnológicas que han sido incorporadas en esta generación de centrifugas BMA. La primera experiencia práctica confirma el éxito que este desarrollo consistente ha obtenido.

Centrifugas de lote: já chegamos ao final do desenvolvimento?

Por muitas décadas, centrifugas foram absolutamente vitais para a produção de açúcar. No decorrer do tempo, sua concepção e características foram modificadas e atualizadas muitas vezes. Será que eles atingiram a fase final de desenvolvimento? O novo lote centrífugo da série E da BMA está definindo um exemplo impressionante de como potencial para o desenvolvimento de um produto já altamente sofisticado ainda oferece: como antes, o açúcar é girado para separar os cristais de açúcar do licor mas a sutil diferença está nos detalhes. Este artigo explica quais são os benefícios concretos que usuários obterão dos mais recente insights técnicos e tecnológicos que foram incorporados nessa geração de centrifugas BMA. A primeira experiência prática confirma o sucesso que trouxe esta evolução consistente.

Introduction

A new design-engineering approach has to be taken if, in the light of ever increasing demands, an already highly sophisticated product is to be further optimised. This is where technical excellence, i.e. the ability to find straightforward solutions to highly complex processes, comes to bear. In developing this generation of centrifugals, the machine's mechanics were consistently reduced to the bare minimum, movements were simplified, and maintenance-intensive components were eliminated. With its E-series centrifugal, BMA is again setting new standards.

Discharging at one go

Efficiency is the measure of successful development. The efficiency level that has been achieved in the new E-series centrifugal generation is primarily due to shorter cycle times, which increases the throughput per hour. A key element to reducing cycle times is the discharger. Since it does without a vertical motion axis, the discharging time is reduced by up to 20 % (see Figure 1). Once the discharging speed has been reached, the discharger only swings horizontally into the sugar layer and removes the sugar along the entire height of the basket at one go. The vertical motion axis could be eliminated because the

we come to the end

NEW PRODUCT LAUNCH

Figure 1. Monaxial discharger in its rest position (left) and swung into its discharging position (right)



E centrifugal basket comes with a novel hub geometry, which also provides an enhanced torsional rigidity in comparison with the earlier hub version. Although the basket volume has been increased, too, the E machine can handle at least one additional batch per hour - with the same drive that is used in the earlier centrifugal series.

Innovative syrup separation

One of the fundamental process-specific innovations is the syrup separation flume that provides for excellent separation into high-green and green syrup without any internal mechanical elements.

The primary aim consists of precisely separating the mother liquor and the dissolved sugar obtained during the water washing phase and during the screen washing phase after the basket has been emptied. The advantages for the sugar-end processes are a higher sugar yield and reduced recirculation of non-sugars. In the final analysis, this also permits producing molasses of a lower purity.

The challenge with syrup separation is to prevent the separated mother liquor from mixing with the wash syrup in order to produce a sufficient amount of very high purity syrup.

The new BMA syrup separation flume solves this task in an excellent manner - both with an optimised shape of the housing bottom and the way that the discharge nozzles are operated, which is done from the outside of the machine only. Back-mixing of the syrup film that flows down along the inside wall of the housing is minimised at crucial points. This is a particular advantage when separating the high-green syrup during the screen washing phase.

By setting the time after water washing, at which the green syrup flap closes and the high-green syrup flap opens, the syrup quality can be controlled in a reproducible manner.



E1810 centrifugals and BMA distribution mixer at Südzucker, Plattling, Germany



Figure 2. Elliptical outlet openings in the basket shell



Revolutionary basket design with elliptical openings

Decisive factors in assessing the performance of a sugar centrifugal are its availability and service life, in addition to efficiency.

By using the most advanced computational methods, BMA has been able to take a revolutionary step forward. Baskets for batch-type centrifugals have in the past always been provided with boreholes. BMA is the first centrifugal manufacturer worldwide to use, in its E-series machines, basket shells with elliptical outlet openings as a standard for batch centrifugal baskets (see Figure 2).

The advantage these elliptical openings have over cylindrical boreholes is that the peak stresses occurring in the basket shell during operation are reduced by more than 40%! This substantially increases the expected service life of the basket.

Since batch-type centrifugals have to meet very high demands, only stainless steel is used for their baskets. They are made from an advanced Duplex steel grade, which is a two-phase corrosion-resistant steel that combines the positive properties of ferritic stainless steel (high strength) and austenitic stainless steels (high ductility and resistance against corrosion).

To reliably provide the openings with a high-quality inside surface finish, a special method is used for introducing these openings into the basket shell. However since the elliptical openings produce a lower notch effect, the surface roughness plays a much lesser role for the service life of the basket than this was the case with boreholes.

Unsurpassed safety

BMA's attention has always been on the safety of its centrifugals, in addition to high sugar quality. The earlier generations of BMA centrifugals therefore already featured very high safety standards, and the E-series again incorporates a number of safety-specific improvements to reflect state-of-the-art technology.

By making systematic use of sensors, potentially critical operating

conditions are detected and communicated at an early stage. Redundant oscillation monitoring features, for instance, reliably spot basket vibrations.

EU regulations, such as the equipment and product safety regulations and the machinery directive, have been consistently applied to ensure maximum safety. This obviously also implies the use of a failsafe control system (f-cpu).

Simplicity and automation for enhanced productivity

The integration of modern automation technology guarantees highest process reliability. Although sugar factories are increasingly making use of on-line measuring systems, e.g. for measuring colour and layer thickness, the full potential of this technology is often not utilised.

Since BMA is a solution provider with know-how not only in design solutions, but also in the process engineering and automation fields, on-line measurement features are directly integrated into the control system of the new E-series machine. This, for instance, allows the addition of wash water to be controlled as a real-time parameter as a function of layer thickness. With on-line sugar colour measurement, variations in quality are, in addition, detected without delay, so adaptations can be made from one batch to the next in order to maintain a constant sugar quality. Optional sensors for monitoring the discharging process are another feature that can be integrated for safe operation of the centrifugal. Excessive forces are reliably detected, and the discharging process can be influenced as required. The data also provide information about the centrifugation process itself, which allows the entire process to be optimised.

The innovations that have been implemented in the new E-series are characterised by their simplicity and the fact that maintenance-intensive components have been consistently eliminated. Here again, BMA relies on sensors and early information about operating conditions or maintenance needs. With the new generation of centrifugals, BMA has reduced maintenance requirements and, consequently, machine downtimes and has minimised life cycle costs. •

CASE STUDY: Successful testing at a Südzucker factory

Figure 3. E1810 prototype



In the spring of 2011, BMA installed a prototype in the German sugar factory Plattling. This factory belongs to the Südzucker Group, the leading European sugar manufacturer (see Figure 3). Immediately after it had been commissioned, the E centrifugal was completely integrated into the production process and operated without interruption to the factory's full satisfaction. All innovations were in parallel rigorously tested, both during the first thick-juice and beet campaigns.

The E machine was placed alongside existing white-sugar centrifugals on one common centrifugal platform. Both the massecuite feed and the sugar and syrup discharge systems, and the interfacing with the overall production process corresponded to the situation of new centrifugals that are finally installed in a factory. Sampling points for green and high-green syrup, and a tank for collecting the two syrups from one complete centrifugal batch were provided in addition.

When representatives of the factory entered the centrifugal platform for the first time they were totally impressed. Even though the machine was running at the time, there was absolutely no discernible noise. The

operating status of the centrifugal, could only be discerned from the display unit.

The weight of massecuite that was fed into the centrifugal basket was checked several times, and the determined 1813 kg confirmed the nominal 1810 kg per batch, which is also what the type name of the medium-sized machine of the E-series reflects.

In white-sugar service, the machine, which was only equipped with a 200-kW drive, performed excellently with up to 28 batches per hour.

In extensive practical tests, the new syrup separation flume, too, proved to perform with the expected excellent syrup separation efficiency.

Criteria that can be used for assessing efficient syrup separation are the difference in green and high-green syrup purity, but also colour values. With 20% high-green syrup, which is a standard percentage of the complete amount of syrup, the colour of the high-green syrup could be reduced with the new syrup separation unit to half of what the normal external syrup separator would achieve.

The practical experience gained with the prototype machine already convincingly demonstrated that the novel design features translate into real benefits for the customer.

The vote of confidence for the centrifugal came from the customer, who not only kept the prototype, but also ordered another four machines of this series (Figure 4)!

Figure 4. Centrifugal station (in Plattling) equipped with four E1810 centrifugals and a BMA distribution mixer

