INTERESTING ASPECTS ON STORING AND HANDLING OF RAW SUGAR (VHP) AT THE MALELANE FACTORY

CAJ DE JAGER

Transvaal Sugar Limited, Malelane

Abstract

The Malelane (ML) sugar mill was built in 1967 to produce both raw and refined sugars. During the 1993/94 season the Komati (KM) mill was built to produce only raw sugar which would be refined by ML.

Part of the KM project was to provide storage and handling facilities for very high pol (VHP) sugar destined for refining at ML which has spare capacity in its refinery due to the seasonal fluctuation in sucrose.

This paper describes the installation of the 65 000 ton raw sugar store and sugar handling facilities from project inception to operation. The description inlcudes the bulk store, bucket elevator, screw conveyors, lump breaker, belt conveyors and control and electrical equipment.

Introduction

ML refinery is designed to refine 1 000 tons of sugar per day (7 000 tons per week), which is done when the sucrose content in the cane is high. Due to the fluctuation in the sucrose through the season the weekly sugar production could reduce to about 3 000 tons per week. This results in available capacity for refining during low sucrose periods. In addition to this ML normally has an off-crop period of approximately 12 weeks, which is more than enough to do maintenance on the refinery. Transvaal Suiker Beperk (TSB) decided to run the refinery continuously at it's designed capacity and reduce the off-crop by approximately 10 weeks. By doing this enough refining capacity would be available to accept 100 000 tons of VHP sugar from KM. To make the scheme work KM sugar had to be stored and then recovered when needed by the refinery.

As the sucrose content in the cane rises, the amount of KM raw sugar that can be refined decreases until no more can be refined. During this period all KM sugar will be deposited in the bulk store where the amount of sugar will peak at approximately 60 000 tons near the end of the season. It was therefore decided that a 65 000 ton bulk store had to be built to store the VHP sugar through the year.

Method

TSB contracted Engineering Management Services (EMS) to help TSB's Technical Services and Development Team with the procurement, project and construction management of the whole sugar handling, storing, reclaiming and melting plants; a new CO_2 plant and changes in the process and services. The final aim was to refine sugar independently of the cane crushing and raw house production. The project was named Malelane Mods with a budget of R14 000 000.

The most expensive part of the project was the handling and storing of the VHP sugar as no infrastructure existed (± R11 000 000).

Equipment

Contracts were awarded to the tenderers who offered the best design using proven technology, as well as providing dust proof equipment with the lowest maintenance requirements.

- The bulk store and civil works contract was given to Industrial Building Construction who subcontracted Murray & Robberts to do the civils.
- The sugar handling contract went to Aeroconveyors who subcontracted these civils to Maxi Beton, electricals to Contromatic and scales to SA Scale.

Bulk store

TSB criteria for the bulk store were:

- Capacity of the store to be 65 000 tons
- Maximum security
- Any part of the sugar to be accessible
- No possibility of sugar leaking out of the store
- All light fittings to be easily accessible even when the store is full
- Sugar to be kept as clean as possible
- Store to be filled with tripper conveyor
- Low cost

In order to comply with all criteria it was decided to build a steel structure with a retaining wall (3 m high) inside the building. This resulted in a bulk store with a 2 m passage all around the stored material. The dimensions of the store are 170 m long by 50 m wide with a roof angled at 30° (the same as the angle of repose for VHP sugar) and the tripper conveyor installed in the pitch at a height of approximately 20 m above the floor. Lighting was installed above the passage surrounding the retaining wall as well as above the tripper conveyor in the pitch of the roof, thus making maintenance easy.

Along the side of the store is a covered off-loading area where bulk sugar trucks 'bottom dump' the sugar into a pit while along the other side of the store is a reclaim area and the overhead control room from where the sugar is controlled and reclaimed by front end loader.

Sugar handling equipment

Incoming sugar trucks arrive at the off-loading area and deposit the raw brown sugar (VHP) through static grisleys into two 30 ton bins situated below ground. The two bins are mounted on loadcells enabling accurate weighing of the product from the trucks. After the driver has entered his registration number a ticket is printed with all relevant details. Once the load of sugar is emptied a curtain opens to release the truck to depart. The moment the bin is empty, the bottom valves of the bins close and the entrance curtain

can be opened to receive a new truck load. Two screw conveyors mounted beneath the bins feed into a bucket elevator which elevates sugar into the roof of the store onto a belt conveyor (CV001) via a throughput weigher (servo balance) with a high accuracy and the weight is printed in the control room.

The belt conveyor (CV001), at an incline of 15°, feeds conveyor (CV002) via a diverter chute fitted with a pneumatic cylinder and automatic control.

Material can be fed either directly onto CV002 which has a tripper car enabling material to be distributed evenly over the entire length of the bulk store, or the material can be channelled via the diverter chute to feed another conveyor (CV003), which then in turn feeds CV004, the main feed conveyor to the refinery.

Sugar from the store is reclaimed with a front-end loader moving it to a reclaim area situated at the side of the sugar store. The front end loader is only used when the feed from CV003 is not in use. This would be the case during break downs or in the off crop when no sugar is off loaded at the bulk store for approximately 10 weeks). The load is then deposited through a lumpbreaker situated in a pit. The lump breaker's function is to break up any lumps formed in the sugar during storage. Material from the lump breaker runs via a chute into another bucket elevator which deposits material onto CV004 (the main feed conveyor). The elevators were supplied by Selenco and the lump breaker by Eriez Magnets.

The CV004 conveyor conveys material to a throughput weigher situated at the head end and from there into a 4 ton check weigh bin. Material from this bin is fed via a discharge chute into a 200 ton holding bin which is the main storage bin for the refinery. The conveying system is designed to convey 60 tons of raw brown sugar per hour. A standard belt width of 600 mm, class 315 three ply, 3,2 mm top cover, bare back, food quality belt was utilised with a belt speed of 1,25 m per second.

Automation

The whole system is operated from a control room via a computer and Programmable Logic Controller (PLC). The total plant lay-out is depicted on a computer screen and the operator can by a simple procedure direct material from the off-loading point directly to the refinery or reclaim and feed it to the refinery.

Unique features

- All conveyors are of the air supported belt conveyor type and CV004, the main reclaim conveyor which feeds the refinery, is the longest conveyor yet installed by Aeroconveyors. The conveyor itself is 350 m long and spans a series of railway lines along its route.

  The reason why Aeroconveyors were chosen was the fact that energy consumption and maintenance are very low as well as the fact that the product is totally enclosed to keep sugar in and foreign materials out.
- To avoid dust build up in the chutes all of these and the scales were lined with a Linetex rubber liner and fitted with a plunger on each side. When dust build up appears, the plunger can be extended to expand the rubber liner inside the chute and all the dust build up falls off.

  At times when the sugar is dry and excessive fine appear, the sugar produces much dust, especially when the store is empty and the sugar falls from the tripper conveyor to the ground. TSB decided to play save and classified the area as an explosion hazard area. Thus, all the electrical equipment is explosion proof. The front end loader is fitted with in board brakes and a spark arrester on the exhaust system.

Conclusions

After one crushing season and an off crop the project is seen as a success. Problems experienced were sugar build up on screw conveyors and bucket elevators. The Aeroconveyors gave no problems and no dust was created by them. However a slight build up of sugar is experienced on the return idlers. All chutes and scales must be cleaned regularly by using the plungers to keep equipment from choking as this occurred when they were not cleaned.