The Sugar Making Process at Eston Mill.

Sugar cane comes straight from the growers at the fields to the mill by vehicle and because Eston has the shortest average hauling distance there is no double handling. Contract hauliers bring in the rest from the zones, which are cleared cane handling areas.

There is a waiting area for these cane vehicles between the mill and the R106 which can accommodate approximately 50 vehicles. The vehicles cross into the mill over a weigh bridge where they are check weighed and logged through the cane procurement system which has allocated specific amounts of cane, on specific days and on one of three shifts. The vehicles are weighed on the way out, after dropping off their cane and the difference in the in and out weights is the amount of cane delivered.

On entering the mill the vehicles will be off loaded by any one of the two Hilos. These Hilos are electrically driven, railed cranes with a specialized tipping head. The grab, hooks onto the specially designed rail and lifts the cane. The cane, which is laid upon chains are attached to this rail and the opposite side, is tipped out as the bar is lifted. Hilo one will tip into the “yard” while Hilo two will tip directly onto the “spiller table”. It is not desirable to tip into the “yard” as it causes double handling, as the “Camecos” will then have to dump it manually into the C1 conveyor. “Camecos” are specialized vehicles, which have large grabs in order to carry cane in large quantities.

There is a control tower situated adjacent to the “spiller table” where the operator and the CTS representative can see down its length. The operator can also see down onto the C1 conveyor and into the “Leveller knife” throat. The CTS representative electronically marks each load of cane to its origin and it is tracked up to the sampling point which is located at the end of the cane conveyor C4. The operator controls the feed rate of the cane from the “spiller table” onto the C1 conveyor via a lever, which drives the chain driven feeder.

There are 5 conveyors, or carriers as they are sometimes known, between the “spiller table and the Diffuser. The “C” denotes that the conveyor is carrying cane. C1 has its speed controlled by the computer system (DCS) to feed cane at the optimum rate. C2 is a metal slate conveyor which takes the cane through the “Cane preparation” section where the cane is levelled by the “leveller knives”, chopped up by the first and second cane knives and carried over to the inclined conveyor C3.

C3 carries the prepared cane, which has been chopped up into manageable pieces up to the “Shredder”. The “Shredder” has a series of hammers, which flatten the cane to expose the cells in the cane for the diffuser process.

The cane is dropped vertically into the “Shredder” which then passes it onto C4 where the cane mass is measured by a scale in conjunction with a speed sensor. This information is used by the Mill and CTS. The Mill uses the mass for production rates as well as part of the computer (DCS) speed control of conveyor C1. At the end of C4, CTS samples each batch of cane and tests it.

From C4 the cane drops down again to C5 which feeds cane evenly across the diffuser inlet. The diffuser is a long steel housing approximately 60 meters long, 8 meters high and 5 meters wide. It has a huge chain and slat conveyor inside which carries the cane through the diffusion process. Hot sugar water known as “scolding juice” is poured onto the beginning to raise the temperature of the cane / water mixture in the diffuser and to help kill bacteria which will eat the sucrose and convert into undesirable invert sugars. The diffuser is a fairly simple looking machine with a complex operation. The height of the cane bed, speed of the conveyor and amount of water passing through it will

determine how much sucrose is extracted from the cane. Water from the “de-watering mills” and fresh water are fed into the process and this water or “Imbibition” is fed back in stages toward the beginning of the diffuser so that the most concentrated juice is at the beginning and the weakest at the end.

The pulp leaving the diffuser is now known as “Bagasse”. There are a series of 10 Bagasse conveyors known as B1 to B10. The “B” denotes that the conveyor is carrying Bagasse.

B1 runs at right angles to the diffuser and drop the Bagasse onto a rising conveyor, B2, which drops it into a chute, which then feeds the first de-watering mill. Here water is added to try and extract the last of the sucrose. The mill presses the water out and it is collected and sent back to the diffuser. The first de-watering mill now feeds B3 conveyor, which raises it up and drops it into the chute of the second and last de-watering mill. Once again, water is added, more sucrose is extracted and the water sent back to the diffuser. The water from the mills, which is sent back to the diffuser, is known as “press water”.

The Bagasse conveyors carry the fuel for the boilers to the boilers, where the excess is rejected and stored in the Bagasse shed.

The juice, which is ready for further processing is taken from the diffuser and pumped to the mixed juice scale. This scale is controlled by CTS and is part of their measurement system to balance the volumes and mass through the mill.

After going through the mixed juice scale, it falls into the mixed juice tank. This tank acts as a buffer to the process but also has a secondary function, which is to remove solids from the juice. From the mixed juice tank the juice passes through a series of evaporators, which removes water by boiling and increases the density or “Brix” of the product. The heat for the boiling process is obtained from steam, which is created in the boilers.

After leaving the evaporators, the juice moves onto the Pans. The pans convert the juice into molasses. There are batch pans and continuous pans. As the names imply, one is a batch system and the other a continuous process. Batch pans are also used to make the seed crystals onto which the sugar will grow. The molasses is named from A to C as it rises in Brix (Density) and drops in purity (amount of sucrose). The A being the start of the process where the A grade sugar is taken and down to the b molasses which is used as seed and finally the c molasses which is pumped to tanks and then sold. This molasses is taken by road via the weighbridge. Each stage requires a step known as crystallization, which demands that the molasses be gently cooled, agitated and pumped to the next step.

The sugar is extracted from the molasses via a spinning separator known as the centrifugal. The “A” centrifugal extract the “A” sugars or raw brown sugar which is sold to the sugar terminal. These are batch units. The “B” and “C” centrifugal are continuous units.

From the “A” Centrifugal, the sugar is dropped onto S1 conveyor, where it is carried to the dryer to be dried. The dryer is a large rotating drum through which hot air is blown. From the dryer the sugar drops onto S2 and then into bins, which act as a buffer for the sugar before it, is collected by road transport, which leaves via the weighbridge.

Picking up the Bagasse trail from B4 we find he bagasse rising up to the feeders of the boilers where it is fed into a chute, which drops it down onto B5. Here, at this chute, it is possible to add bagasse from the bagasse shed. B 10 drops the bagasse from the store into the same chute as B 5.

B5 is a vertical slat conveyor which scoops bagasse along its length, dropping it down into the vertical feeder chutes of the boiler feeders. From here the excess travels to the bagasse shed via conveyor B 6. At the shed the bagasse is carried down its length by B 7. A special machine known as the scratcher removes the bagasse with the aid of a plough and piles it in the bagasse shed where it is stored for further use. Excess bagasse is removed by “Cameos” and heaped outside.

The scratcher has a conveyor on it to drop bagasse up and down the width of the shed. This is B8. In a pit of the shed, lies B9, which is a horizontal conveyor that runs the length of the shed. When bagasse is required for the boilers because the mill is not crushing or the volumes are low, the scratcher is used to move bagasse onto B9, which feed B10, which joins B5 at the end of B4 and feeds back to the boilers.

Bagasse can be dried by circulating it through the bagasse conveyors B9 exit conveyor, B10 rising to boilers, B5 boiler feed conveyor, B6 shed feeder conveyor, B7 shed top conveyor, B8 scratcher, and back to B9 exit conveyor.

The boilers raise steam which is not only used in the boiling process but used to drive generators which make enough electricity to run the entire mill, and also prime movers to drive cane knives, shredders and pumps. The growing cane in the area absorbs carbon dioxide released from the boiler stacks. Most of the “smoke” seen rising from the stacks is in fact water vapour from the “scrubbers”.

Water from the factory is let down to dams via different processes depending on its type and after filtration through special clays and bacteria, it is used for cooling and “Scrubbing” of boiler smoke.

Storm water run-off generated across the entire site (viz building roofs and roads) is collected through a series of interconnected underground storm water drains which have been constructed around the factory. This run-off is diverted to a 20-minute storm water holding pond. The overflow from this pond feeds the canal supplying the solids settling (sedimentation/ash dam). Apart from receiving storm water from the 20-minute pond, the sedimentation/ash dam also receives treated domestic and factory effluent as well as the boiler scrubber water.

Effluent generated from the factory ablution facilities is collected into a septic tank, and then passed through two rotating disc biofilters before discharging into the factory effluent channel feeding two aeration ponds.

Wastewater generated from factory processes is collected through a series of interconnected effluent drains which have been constructed around the entire Mill. The factory wastewater is first mixed with treated domestic effluent (from ablution facilities) and then fed into the aeration ponds. The aeration ponds are connected in series and both are fitted with mechanical stirrers/agitators to facilitate the aeration and breakdown of organic matter to maintain Chemical Oxygen Demand (COD) parameters within the permitted limits stipulated by the environmental legislation.

Aerated effluent then gravitates from the second aeration pond into the clarifier. Treated effluent is then overflowed from the clarifier, into a channel supplying the ash settling dam. Sludge from the clarifier is either re-circulated into the aeration ponds or discharged into the channel supplying the ash settling dam. Effluent filters through a network of filters situated at the bottom along the wall of the ash pond. Filtered effluent from the ash settling dam is collected in the clear water dam from which it is re-circulated back to the factory for scrubbing boiler stack emissions.

Any excess treated clear water is either rateably discharged into the natural water course below the clear water dam or used for irrigating in the cane fields.