

# First vertical VFC sugar cooler successfully commissioned



For the reconstructed Savannah refinery in Port Wentworth, Georgia/USA, BMA delivered a drum dryer/cooler, which was already commissioned in July 2009. With a diameter of 4 metres and a length of 13 metres, this dryer will without any doubt count among the largest drum dryers for crystal sugar that are in operation in the USA. It has a rated capacity of 135 t/h.

Since some of the essential sections of the refinery were not yet operational in mid-2009, the dryer/cooler was at first only operated with a reduced throughput. Owing to the configuration of the drum, with separate compartments for drying and cooling, sufficient amounts of cooled sugar could be produced until mid-September. After that time, the throughput was to be increased, so that additional capacity was required for sugar cooling.

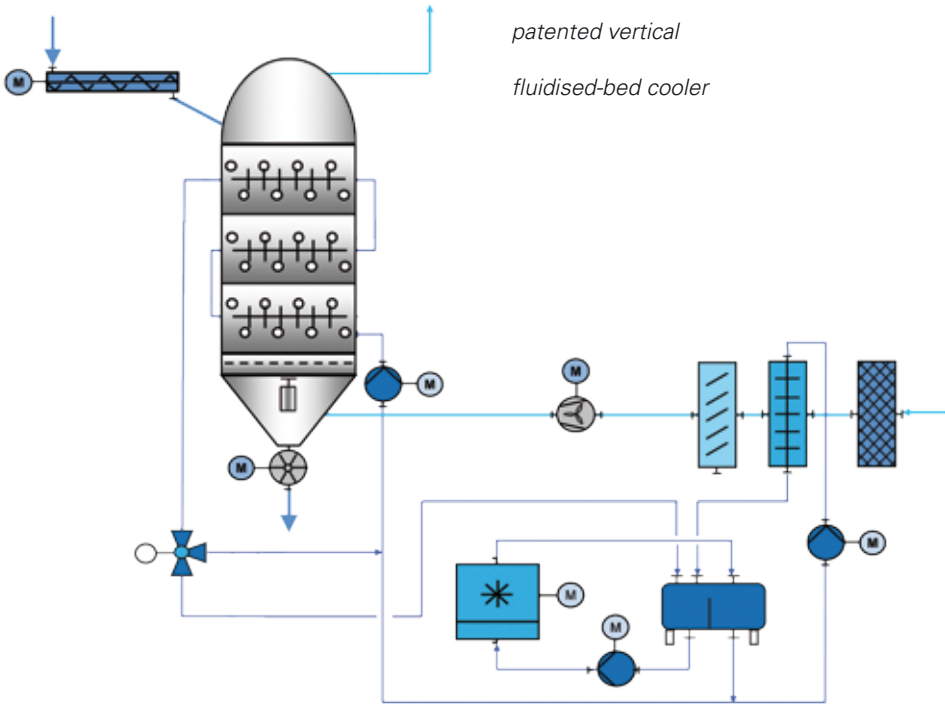
For this purpose, BMA's first vertical sugar cooler (VFC) was installed and put into service.

The technical advances that have been achieved with this unit primarily consist of reducing the required amount of air, while still ensuring that the residual product moisture is reliably removed. The space taken up by the unit was to be reduced by further intensifying the heat transfer at the cooling tubes. Additional modifications concerned the air distribution plate, which was to be replaced with a less sensitive element; and installation and connection with the process media were to be made more efficient.

To translate these objectives into sound machine technology, several of the tried-and-tested cooling tube blocks were placed on top of each other, but the basic principle of fluidised-bed systems, in which the air flows from bottom to top, was maintained. The only difference is that the same process air now passes the different elements of the fluidised bed in succession. The advantage of this configuration is that much less process air is required than in the known horizontal coolers.

*Sugar cooler during  
assembly in the  
workshop*

*Sugar cooling in the patented vertical fluidised-bed cooler*



The plant, which has a throughput of 135 t/h of sugar, has now been installed in the factory of Imperial Sugar. It uses only about 1/8th of the air usually required by other fluidised-bed coolers with the same capacity. Although the air rate has been dramatically reduced, there is still sufficient air to absorb the residual product moisture. The higher the air rises inside the fluidised-bed cooler, the more increases its temperature and, consequently, its ability to absorb water.

The option of subjecting the sugar to secondary drying inside the cooler is not meant to replace the sugar dryer, but to add to the efficiency of the drying process. The sugar retention time in the cooler is a few minutes, which considerably increases the overall period during which the product can give off its moisture to the air.

The turbulent sugar bed the process air creates between the cooling tubes provides for excellent heat transfer. Because of the turbulent flow conditions and the constant and intensive movement of the fluidised bed material, the coefficient of heat transfer is several times that of known fixed-bed coolers. This explains VFC's compact dimensions.

The space requirements of the VFC in Port Wentworth are as follows:

Width	1.6 m
with service space	4.0 m
Length	2.0 m
with service space	5.5 m
Height between product inlet and product outlet, including air lock	8.0 m

The discharge element, which is arranged below the cooling tube banks, not only allows the sugar to pass through it from top to bottom in a controlled manner; the process air, too, passes this element across its entire cross-sectional area and enters the process chamber. With a special control system, the opposite flow directions can be influenced and coordinated as required. A number of peripheral pneumatic cylinders are used as actuators.

The complete apparatus, including cooling water cycles, discharge lock, incoming-air fan and various control loops, is controlled with a control system supplied by BMA and a local touchscreen



*Air cooling and  
dehumidifying facility*

that is incorporated in the operator panel. This is where the process parameters are displayed and logged and where they can be changed if necessary.

The cooler was commissioned during the second half of September. The apparatus the customer Imperial Sugar took over at the end of the two-week commissioning and testing period operates very reliably. At first, the apparatus achieved the defined cooling performance only at reduced throughput rates, but it was possible to positively ascertain the cause of these limitations during the commissioning phase.

With the benefit of the insights gained at that stage, the cooler was modified early in December 2009, and the capacity of the plant was increased to such an extent that the arriving amounts of the produced sugar could be cooled to the desired temperature without any problems.

BMA's novel VFC cooler delivers a very stable performance, and the sugar outlet temperature can be maintained at a near-constant - level irrespective of fluctuations in refinery production rates. There can be no doubt that the plant has the required reserve capacity to reach the specified throughput rate of 135 t/h.

The prototype VFC installed in the Port Wentworth refinery fully comes up to the expectations placed on it. All defined targets have already been reached with this prototype version: the required air rates and the space requirements have been reduced, and the reliability in operation has been enhanced. There is also excellent agreement between the calculation models prepared as part of the development process and the values recorded with the installed plant.

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