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INSTALLATION AND OPERATION OF A SOLEX THERMAL SCIENCE SUGAR COOLING UNIT AT A SUGAR PLANT IN USPENSKY, RUSSIA

Introduction

Solex Thermal Science has become a world leader in the indirect heating and cooling of powder and bulk solids in many industries world-wide, including chemicals, polymers, fertilizers, detergents, minerals, oilseeds, grains, food products, sugar and biosolids. Since the year 2000, Solex has introduced their indirect heat transfer technology to the sugar industry with great success. The technology has been recognized as a proven and effective method for cooling sugar crystals before storage and packaging. This type of indirect cooler has been successfully installed all over the world under different climate conditions, in countries like France, Germany, Portugal, the United States, Mexico, Poland and Russia to name a few. The plants using Solex sugar cooling technology specialize in sugar beet plant, sugar cane plant and starch and derivate sugar (Maltose, Sorbitol). The Solex cooling unit can be installed either as a primary cooler or a secondary cooler and is readily adaptable to plant retrofits.

Equipment Description

Solex indirect heat exchangers are a unique piece of equipment that consists of a bank of vertical, closely spaced, hollow, stainless steel plates. The sugar flows slowly by gravity between the plates in mass flow. Cooling water flows counter-current through the plates resulting in high thermal efficiency. The cooling occurs by heat transfer through the sugar particles and is exclusively based on conduction. This cools the sugar indirectly and eliminates emissions and the need for fans, scrubbers or other costly air-handling equipment. The sugar is not in contact with the air, eliminating the risk of introducing bad odors or microbiological contamination to the product.

Solex sugar cooling unit in Russia

At the bottom of the heat exchanger unit is a vibrating discharge feeder that creates mass flow and regulates the sugar throughput. Solex technology is subject to patents and patent applications in various jurisdictions around the world. Solex also has a strong research and development department, who have developed many patent-pending applications for bulk solid heat exchange designs, such as dryers and high temperature coolers.

Installation & Operation at Uspensky

The Uspensky plant operates both as a beet sugar plant as well as a refinery (outside of regular beet campaign), therefore, built-in flexibility of the sugar cooling step is of the utmost importance. The installation of a new sugar cooler at this plant was part of a large program of revamping to increase capacity, as well as to modernize the plant.

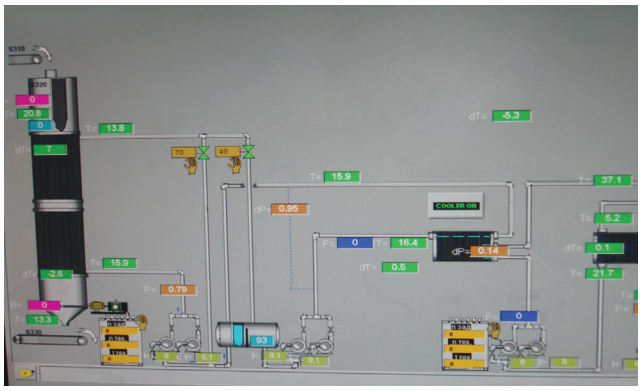
In order to achieve optimum storage and packaging for white crystal sugar, it was important to control the temperature of the sugar and to have a uniform temperature year round. For this reason, the cooler has been designed to work under both summer and winter conditions. During the summer the plant is refining raw sugar and during the winter they work as a sugar beet plant.

For Uspensky, the ideal sugar storage temperature for the local ambient conditions is approximately 30°C.

According the Technical Director at the sugar plant of Uspensky, the choice of the Solex sugar cooling unit was based on the following criteria:

- Compact design which was easily integrated into the existing structure
- Extremely low energy consumption of approximately 0.33 kW.h/ton of product
- No air consumption and therefore no large fans and ducts and no need for large and costly auxiliary equipment such as air filters or cyclones.

The cooling water circuit needed for the exchanger was designed using a chiller in order to be completely independent of the weather conditions to ensure ideal storage and packaging conditions year round, even during the summer months.



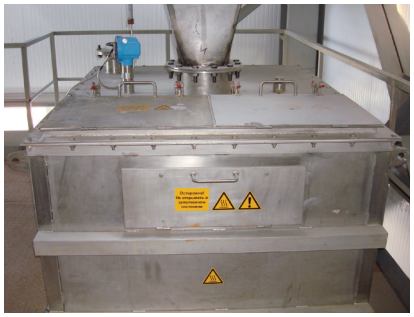
Process Diagram

Cooling Water System (Chiller)

As this technology does not use air to cool the product, the plant was able to realize important savings by avoiding the expensive installation of additional air pollution equipment. Additionally, air is not used in the Solex heat exchanger providing an important increase in the quality of the final sugar product, as the risk of external contamination with bad odors or microbiological contaminants is completely eliminated.

The operation of the cooler is completely automated, with the unit's Level and Temperature Control System integrated in the plant's Distributed Control System (DCS). Typical process operating data for the Solex sugar cooling unit during the campaign in 2007 was cooling 70 tons per hour of sugar from 66°C to 28°C using cooling water at 20°C.

The maintenance of the equipment consists of washing the interior of the exchanger at the end of the campaign. This operation is extremely simple as large doors allow easy access to the plate banks. Both the inlet hopper and the vibrating discharge feeder are also equipped with inspection and maintenance openings.



Inlet Feeder with Radar Probe

Vibrating Feeder

Inlet Sugar Feeder

Sugar Outlet