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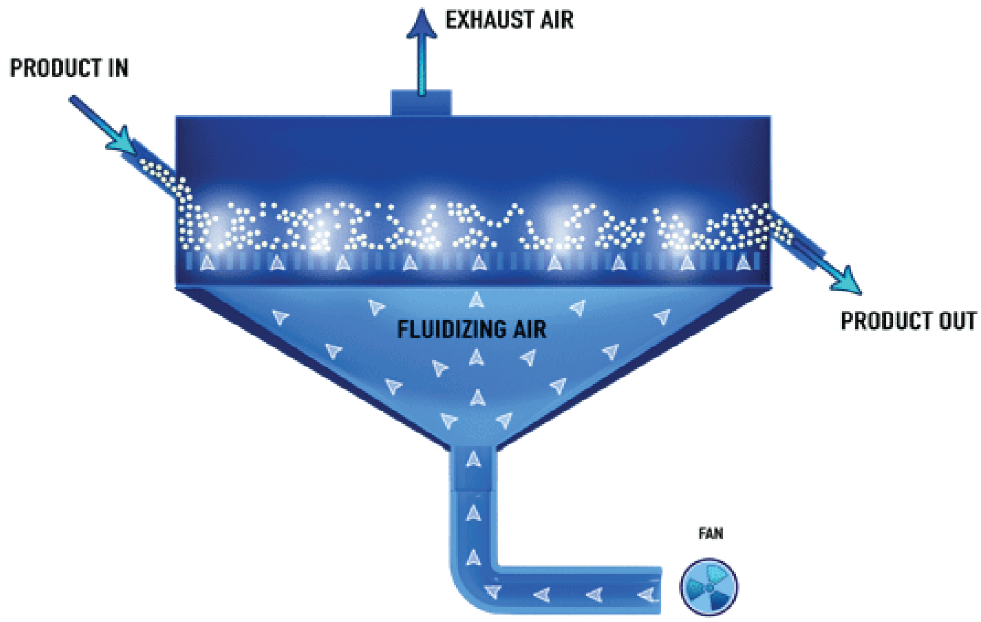
How Fluid Bed Technology Works for Cooling, Heating and Drying Bulk Solids

SOLEX
THERMAL SCIENCE

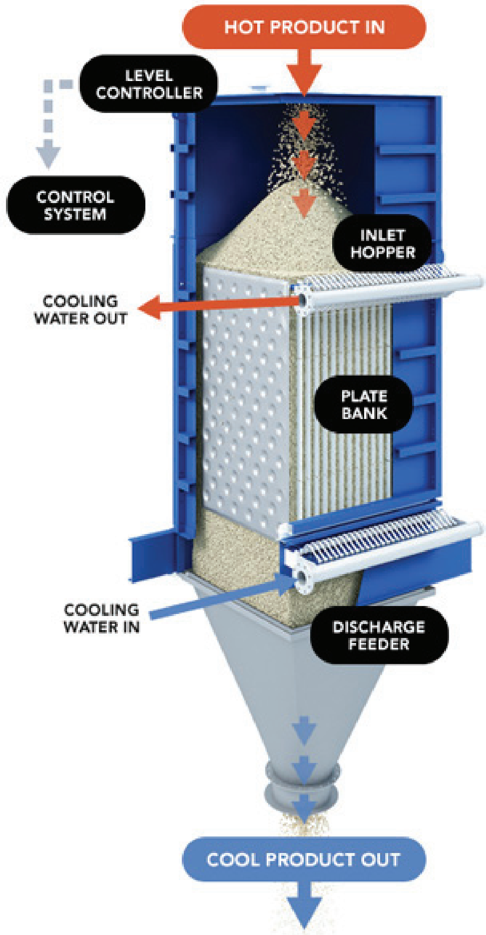
Fluid bed technology is used for cooling, heating and drying of bulk solids materials. Fluid bed heat exchange takes place by passing a gas (most commonly air) through a perforated distributor plate which then flows through a layer (bed) of solids. The air performs two functions. First, the air flows through the bed of solids at a velocity sufficient to support the weight of the particles, which creates a fluidized state enabling the particles to flow. Second, the air in the fluid bed serves to cool, heat or dry the particles as it comes into direct contact with the solids material within the fluid bed chamber.



FLUID BED HEAT EXCHANGERS RELY ON THE USE OF LARGE VOLUMES OF AIR

The premise behind fluid bed technology for cooling and heating is that large volumes of air are used to both fluidize the material (required to enable the product to flow) and to act as the heat exchange medium – adding or removing heat from the process.

With fluid bed coolers, ambient air is taken in using large fans and, in most climates, the air must be chilled (or treated) before being blown across the product using large horsepower fans. The air leaving the fluid bed cooler is then discharged through an emissions stack. Both the chilling process and the circulating fans have high energy requirements.



HOW DOES FLUID BED HEAT EXCHANGE TECHNOLOGY COMPARE TO SOLEX TECHNOLOGY?

Solex technology offers a highly efficient alternative to fluid bed cooling. Solex coolers work by cooling bulk solids indirectly using water. No air is used in the cooling process. With this indirect cooling technology, chilled water is pumped through a vertical bank of hollow stainless steel plates while the bulk solid passes between the plates at a rate sufficient to achieve the required cooling. This offers several significant advantages compared to fluid bed technology.

ENERGY REQUIREMENTS OF FLUID BED COOLING

The inherent problem with using air to directly cool bulk solids is the large quantity of air required by the fluid bed cooler and the expense involved in chilling, processing and cleaning that air.
Table on the right is an energy comparison between a fluid bed cooler and the Solex indirect cooling technology.

	Fluid Bed Cooler	Solex Cooler
Electrical Fan Power	400 kW	–
Electrical Pump Power	–	25 kW
Bucket Elevator Power	–	20 kW
Total Power Consumption	400 kW	45 kW
Operating Hours / Year	8000 hrs	8000 hrs
Total Energy Cost / Year ($0.05/kW)	$160,000 / Yr	$18,000 / Yr

FLUID BED AND EMISSIONS

Fluid bed cooling of bulk solids results in high emissions. Using air to cool bulk solids is a "once-through" proposition. Air is taken in, chilled, passed across the product, and must then be disposed of through a stack. The large quantity of air required for direct cooling results in a large quantity of dust and emissions. Permits for stacks are becoming more difficult to acquire, and with ever-tighter pollution controls, emissions must be cleaned and scrubbed before being dumped into the atmosphere. Associated costs are high.

SOLEX TECHNOLOGY IS EMISSIONS FREE

With Solex indirect cooling, the water is re-used repeatedly by being recycled in a closed loop system. The cooling media does not come into direct contact with the product, so no dust or emissions are created. This eliminates the need for pollution control equipment and makes tight emission limits easier to meet.

FLUID BED, PRODUCT QUALITY, AND ENERGY

Since ambient air comes into direct contact with the product as the cooling medium, the temperature and saturation point of the air must both be considered to avoid process issues. In many climates, the temperature of the ambient air is higher than that required to achieve cooling, which means the air must be cooled prior to use. Another issue is the saturation point of the cooling air. If this is not addressed, moisture can migrate from the air to the product which results in agglomeration and subsequent spoilage.

In order to ensure saturated air does not come into contact with the product, air must be cooled below the required temperature to condense the water out and then reheated to the optimum cooling temperature. The chilling and reheating ambient air consumes significant amounts of energy. The process of condensing the water out of the air to enable it to be used in the fluid bed requires three times the energy as using chilled water in a Solex cooler.