Fluid beds and rotary dryers and coolers

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Potash rotary dryer

Phosphate rotary dryer

Fluid beds and rotary dryers and coolers

Drying is the removal of water from solids, liquids or gases. In almost all industries, at some step in the process, material needs to be dried. Drying can be the beginning, intermediate or final step in the material flow. Efficient drying systems therefore are critical to successful process design and implementation.

Because of the hundreds of different materials requiring drying, the diversity of feed materials, and varying final product requirements, knowledge, judgment and pilot testing of materials are requisites to good dryer design. The three most important factors to consider in dryer design are: ability to meet final product specifications, materials handling ability, and safety to equipment and operators.

The two primary methods for removing water are mechanical, such as screens or filters; and through evaporation using thermal processing equipment.

Metso Pyro Division, makes a range of thermal drying systems including rotary dryers, fluid bed dryers and several types of indirect dryers.

Metso rotary dryers

Rotary dryers are slightly inclined cylindrical shells supported by two riding rings running on a set of rollers. Rotary dryers are suitable for drying a wide range of materials because of their ability to process materials having considerable variation in size and composition.

A rotary dryer uses lifters mounted in the shell to produce a cascade of particles falling through a hot gas stream. The mechanical lifting of the material allows rotary dryers to be used to dry materials ranging from fine filter cake to coarse minerals. It also helps in breaking up lumps, promoting a more uniformly dried material.

The proper design of a rotary dryer is based upon several key factors. The dryer diameter determines the gas velocity. Lifter design determines how the material will fall through the gas stream. When designed correctly, the full width of the dryer becomes a shower of material. Chains may also be used when processing very wet material to improve heat transfer. Dryers are also designed for either parallel flow or counterflow. Metso uses real-time modeling programs to simulate the lifter design for optimum performance.

Our patented rotary air seal, marketed under the trade names GOO-DEAL and SUPERDEAL, is installed between the rotating shell and fixed hoods at both ends of the dryer. Tight sealing is critical because leakage in or out of the dryer affects the thermal efficiency and capacity of the dryer.

Metso Pyro Divison has supplied over 4,000 rotary dryers and coolers around the world. These dryers have been supplied under the StanSteel, Allis-Chalmers, MPSI, Kennedy Van Saun (KVS), Armstrong Holland and Svedala brand names.

Nickel ore rotary dryer

Fluid beds

The term "fluidized bed" usually refers to a bed of finely divided solids through which a gas is passing and which is in a state between that of a static bed and one where all the solids are suspended in the gas stream, as in pneumatic conveying.

The introduction of an appropriate gas flow into the material bed brings about the onset of fluidization. Bubbles of gas pass through the bed of material creating a condition of rapid mixing. The bed has the appearance of a vigorously boiling liquid, and in fact the bed of material takes on many of the properties of a fluid. It exerts a hydrostatic head, and the material will flow through a hole in the vessel or over and under a weir within the bed.

The boiling action in a fluidized bed brings particles into contact with each other, removing dust that is carried off in the gas stream. The same boiling action ensures very thorough mixing, giving uniform temperature conditions and enabling complete drying to take place without overheating the material.

The Metso entrainment dryer is used primarily for the drying of fine powders, in filter cake form or solids in suspension in slurries. It differs from the conventional entrainment dryer in that fluid bed technology has been incorporated into its design to provide longer residence times and prevention of build-up on the static surfaces.

Metso has supplied over 150 fluid bed dryers and coolers under the Pyrotherm, Allis Chalmers and Svedala brand names.

Entrainment dryer

Mineral sand dryer/cooler

Stainless steel steam tube dryer

Steam heated aluminum hydrate fluid bed dryer.

Indirect systems

Indirect drying systems are used when the material to be dried cannot come into contact with the combustion gases normally used in drying. This situation often exists in chemical and agricultural situations, but also in some mineral and waste applications.

Steam tube dryers

Steam tube dryers have a series of tubes running down the length of the rotating shell and passing through the bed of feed material. Steam passes into the tubes, condenses and uniformly heats the feed material.

Indirect fired rotary kilns

An Indirect Fired Rotary Kiln has an alloy steel shell, surrounded by a refractory lined furnace. The material moves through the alloy shell, which is heated by combustion gases in the furnace. Heat is transferred principally by radiation.

This arrangement makes it possible to dry and process very fine material because the gas velocity inside the alloy shell is very low, made up of only the moisture evaporated from the feed material.

Indirect fluid bed dryers

Like the steam tube dryers, the indirect fluid bed dryers use steam tubes in the material bed to transfer energy to the feed. The tubes are immersed in the bed, heating both the bed of material and the fluidizing air.

Coolers

All of the drying systems can also be used as coolers. In each case either ambient air or cooling water can be used to cool material. We classify coolers into 3 types: Direct air swept, Water cooled shell, and Water tube.

Systems

Metso supplies both separate drying units and complete systems. Complete systems can include feed preparation, exhaust gas cleaning and plant control systems.

Whether it is a separate unit or a complete system, Metso provides process and mechanical warranties to guarantee unmatched performance. This is why the Metso dryers consistently work with lower fuel consumption and higher availabity.

Combined rotary indirect dryer and cooler

Experience is key

Metso has supplied over 4,000 dryers for over 400 different materials for operations around the world. This experience translates into better performance, higher availability and easier maintenance.

Materials act differently during drying. They may be sticky when being fed to the dryer, or they may become sticky during drying. They may agglomerate during drying, or become dust. In some cases the material needs to be dried completely, "bone dry", and in some cases the material is only partially dried.

Metso has experience in all of these situations. In combination with different materials we process at operating plants, Metso has done testwork on many more. This gives Metso an unmatched database of material handling and drying characteristics for plant design.

Some of the materials processed by Metso dryers include:

ABS Resin	Copper Concentrate	Magnesium Sulfate	Sewage Sludge
Acrylic Resin	Copper Oxide	Manganese	Silica Sand
Activated Carbon	Corn Fiber	Melamine Resin	Soda Ash
Aggregate	Corn Germ	Mica	Sodium Bicarbonate
Alfalfa	Corn Gluten	Molybdenum Sulfide	Sodium Chlorate
Aluminum Hydroxide	Corn Meal	Molybdic Oxide	Sodium Dichomate
Ammonium Sulfate	Cryolite	Nickel Concentrate	Sodium Phosphate
Barite	Dextrose	Perlite	SodiumSulfate
Bauxite	Diatomaceous Earth	Phosphate	Sodium Sulfite
Beet Pulp	Dolomite	Polypropylene	Soybean
Bentonite	Feldspar	Potash	Spodumene
Blast Furnace Slag	Fish Meal	Polyphosphate Salts	Sunflower Seeds
Borax	Fluospar	Potassium Nitrate	Tin
Boric Acid	Fructose	Potassium Sulfate	Titanium Dioxide
Calcium Carbonate	Gelatin	PVC Homopolymer	Trona
Calcium Sulfate	Gilsonite	Quartz	Uranium
Carbon Black	Ilmenite	Rapeseed	Urea
Cement Klinker	Iron Ore	Rice	Vanadium
Chrome Sand	Lactose	Rutile	Wood Chips
Citric Acid	Lead Concentrate	Salt	Zinc Concentrate
Clay	Limestone	Sand	
Coal	Magnesite	Sawdust	



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