Spray Drying Technology

Producing Powders for World Markets

Environmentally Friendly

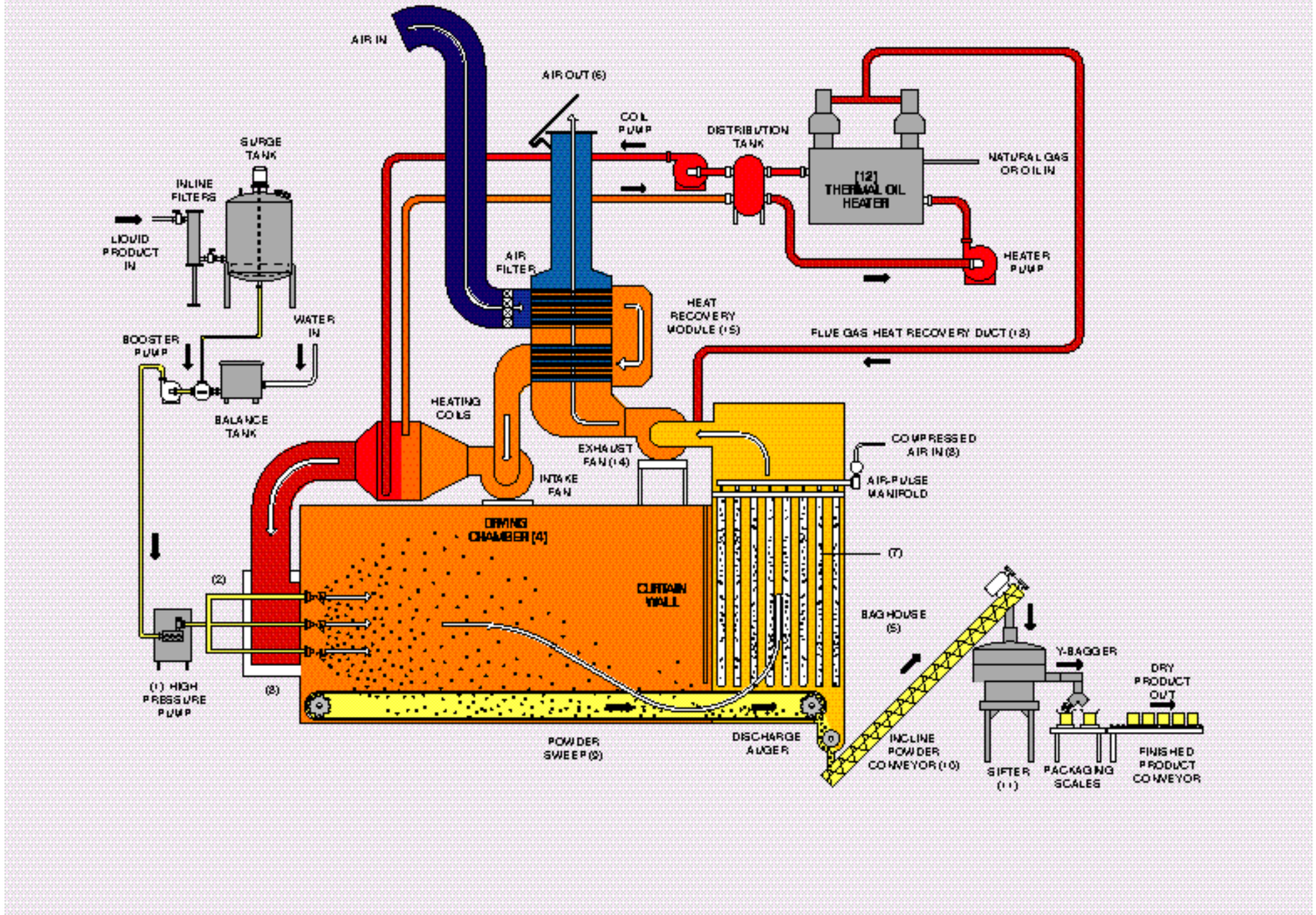
Energy Efficient

- EconoHeat™ Spray Dryer produces powders at very low cost
- Heat Recovery option reduces fuel costs more than 20%
- Produces high quality powder from heat sensitive liquid products
- Integral Baghouse design complies with all emission standards
- Lo-Nox burners available in direct-fired and indirect-fired configurations
- Requires minimal floor space and building height - low installed cost
- Computer controlled - operate, monitor and record all data in real time
- Produce agglomerated and free-flow powders with optional equipment

FES International, Inc.

A WORLD LEADER IN PROCESS TECHNOLOGIES

Econoheat™ drying systems employ standard and optional components resulting in an extremely efficient drying process.



PROCESS DESCRIPTION

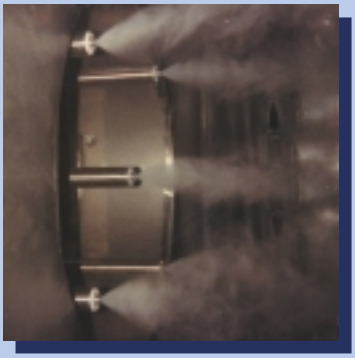
Preheated or cold liquid is delivered by a triplex pump (1) through nozzle atomizers (2) to the drying chamber under 2,000 to 3,000 pounds pressure (135 to 205 bar). The number of nozzles and orifice size vary according to the capacity of the dryer and product requirements. Heated air, at temperatures ranging from 270°F to 400°F (132°C to 204°C), enters the economizer (3) with the atomized liquid and flows as a heated mist into the drying chamber (4). The relatively low temperatures are necessary for dehydrating heat sensitive food and pharmaceutical products. Immediate evaporation, resulting in cooling of the air and powder, takes place with most of the powder falling to the dryer floor. Moisture laden air, containing a small amount of powder flows through the dryer into the baghouse (5) area and subsequently exhausts to atmosphere (6). Remaining powder in the air is retained in the drying chamber by a series of cloth dust collection bags (7). Powder is continuously removed from the bags by pulsing compressed air (8) into the bags intermittently through a high pressure air manifold. Powder is continuously moved to the rear of the dryer (9) where it is picked up by a pneumatic system or screw conveyor (10) for transport to a storage hopper or sifter (11) for classifying and packaging.

The method of heating the drying air shown in the diagram is a thermal fluid heater (12). This is the most fuel efficient method of heating air and also results in nitrate-nitrite free powder. The thermal fluid liquid employed is FDA approved and has many years of useful life. The systems, when properly operated, will provide years of maintenance-free service. Hot exhaust gases from the thermal heater (13) is ducted to the inlet side of the exhaust fan (14) and HR-20 module (15) so that all possible heat is recovered from fuel combustion.

The HR-20 modules, manufactured of stainless steel, recover approximately seventy percent (70%) of waste heat from the dryer and thermal heater. On average, in temperate to cold climates, fuel reductions range from twenty to more than thirty percent in winter.

Considering that many Econoheat™ dryers operate upward of 6,000 hours per year, maintenance costs are quite small. Pump packing glands and nozzle orifices are parts replaced most frequently. Inlet air filters and dust collection bags normally have a one year lifetime and with some products, bags may last much longer.

ECONOHEAT™ SPRAY DRYER



The Econoheat™ head design provides optimum utilization of the hot air stream. Mixing vanes within the head blend the atomized liquid feed with the hot air stream to quickly and efficiently evaporate the moisture. In combination with the HR-20 heat recovery system, heat consumption is a mere 1400 btu / lb. of water evaporated (733 kcal / kg.) even with ambient temperatures as low as -30°F (-34°C). Spray nozzles are easily removed and replaced through a stainless tube that both supports the nozzle and protects the liquid from the high inlet temperatures as it flows to the nozzle. Spray pipes and nozzles are available in various configurations to achieve desired particle size, bulk density and product quality.

The HR-20 Heat Recovery is the only system available today designed and manufactured with the food industry in mind. It is a stainless steel "bare-fin" tubular unit designed for harsh process environments and can be CIP cleaned when necessary. The air-to-air design eliminates the need for pumps, heat exchange fluids, or gases, resulting in a most efficient and maintenance-free system that will operate effectively for many years.

The Pulse-Flex™ dust collection system is the most effective unit available today. Top loaded snap-in bags prevent leakage of powder to atmosphere with efficiencies that comply with or exceed the most rigorous emission standards. Bags are available in many different types of material depending upon the product being dried. Bag life expectancy up to 30,000 hours of operation has been achieved on some products.

Optional systems are available for control of the drying process, from solid state recorder-controllers to programmable logic controllers (PLC) with touch screen and/or desktop PC interfaces for operator control. PLC units can monitor and control all the functions of the dryer including very precise control of moisture in the final powdered product. The PLC includes monitoring and recording of alarm conditions with annunciator lights and/or horn to alert personnel. This early notification helps prevent expensive cleanups as well as to alert personnel of possible safety hazards.

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