

Komline-Sanderson Paddle Dryer/Cooler

**Thermal processing for
drying, heating and cooling**



Komline-Sanderson

Thermal processing with the K-S Paddle Dryer/Cooler

With the K-S Paddle Dryer/Cooler, powdered, granular, or pasty materials can be heated (e.g. for drying) or cooled indirectly by means of a heat transfer medium (steam, oil, water, or glycol). Superior agitation produces excellent heat transfer rates and uniform product characteristics. Absence of large air flows virtually eliminates dust problems, and reduces energy consumption. The K-S Paddle Dryer/Cooler has proven to be one of the most efficient devices for indirect heat transfer.



The K-S Paddle Dryer/Cooler is used for:

- Drying
- Heating
- Cooling
- Reacting
- Melting
- Tempering
- Solvent Stripping
- Crystallizing
- Sterilizing
- Calcining
- Roasting
- Cooking/Braising

Applications

Some of the applications where the K-S Paddle Dryer/Cooler has proven itself as an efficient solution include:

Chemical - Drying of organic and inorganic compounds, solvent stripping and recovery, controlled thermal reactions, calcining up to 750°F (400°C), and cooling.

Petrochemical - Heating and solvent stripping of materials such as polyethylene and polypropylene, and crystallizing PET.

Pharmaceutical - Drying and solvent stripping, blending and drying of mixtures, and cooling of powders.

Food - Sterilizing, denaturing flour, converting “cooking” starches, blending and thermal processing, cooling hygroscopic beverage powders, tempering fat containing products, toasting, cooking, and melting.

Metal/Mineral - Drying metal hydroxides, metal oxides, and metal ores to very low residual moistures, and cooling powders.

Environmental - Drying sludges and by-products to reduce disposal cost or to convert waste into marketable by-products.



Benefits of the K-S Paddle Dryer/Cooler

Versatility

The K-S Paddle Dryer/Cooler is used to thermally process a wide variety of products. Feedstocks can be slurries, pastes, cakes, granules, or powders. Designs for continuous or batch operation are available.

During thermal processing, solid or liquid additions can be introduced to the process mass at various points along the machine.

Two-Zone design allows for two distinct operating temperatures, allowing for drying/cooling, heating/cooling, or multi-temperature reactions to be performed in a single unit.

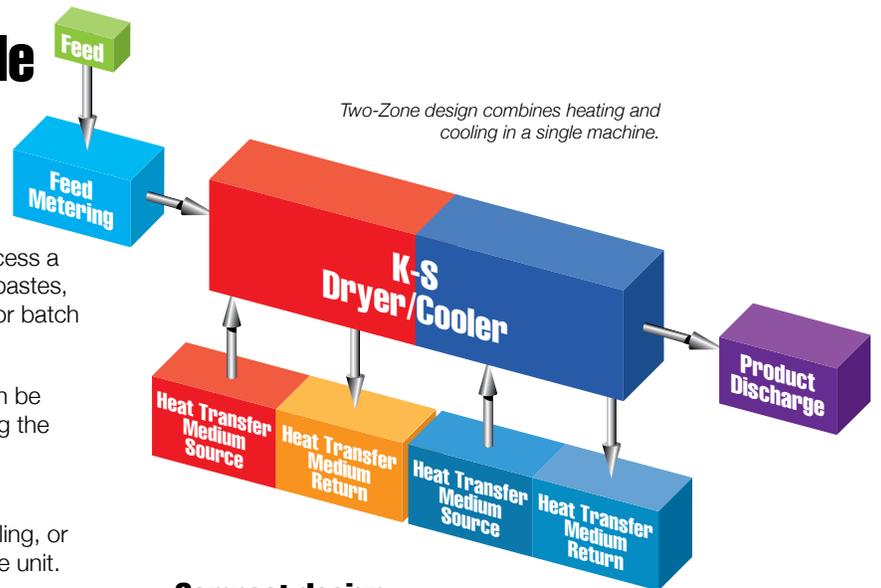
High heat transfer rates

Dual counter-rotating shafts with unique intermeshing wedge-shaped paddles produce uniform mixing, and optimize the heat transfer rate. The self-cleaning effect caused by shear on the paddle surface maintains high heat transfer rates even when processing sticky materials that might have a tendency to foul other designs.

Uniform temperature and residence time

Localized mixing around each paddle creates a homogeneous condition in the K-S Paddle Dryer/Cooler. Movement in a continuous processor is essentially plug-flow with some back mixing.

Products can approach the heat transfer medium temperature, up to 750°F (400°C) or down to -40°F (-40°C).



Compact design

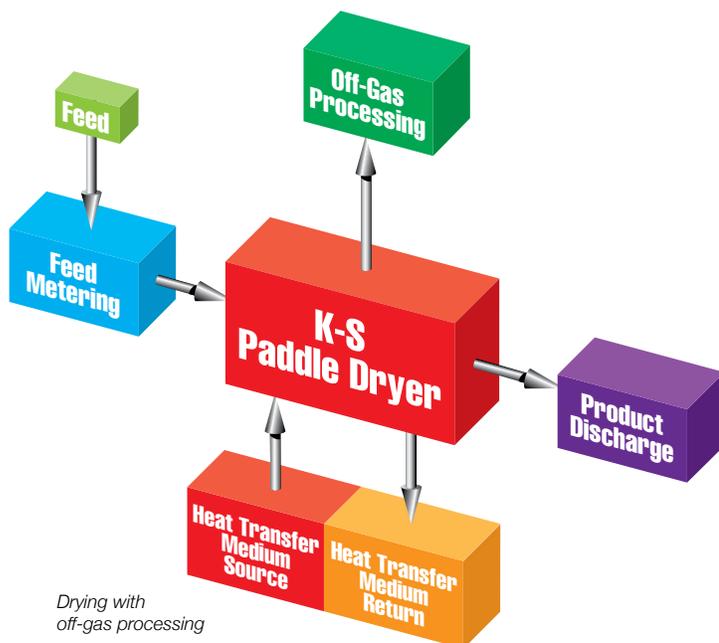
The K-S Paddle Dryer/Cooler has a high heat transfer area to volume ratio. Typically, all of the heat transfer area is covered with product and effectively used. This, combined with a high heat transfer rate, results in a compact machine with less space requirements and correspondingly lower installation cost.

Controlled environment

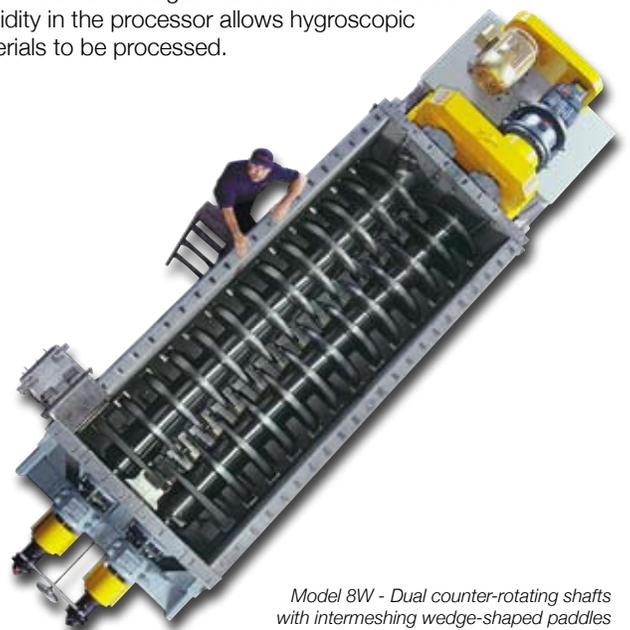
Enclosures can be designed to operate at atmospheric, vacuum, or pressurized conditions.

Drying can often be accomplished with little or no external sweep gas. A small pressure differential, created by a fan, removes volatilized vapors from the heated material. Vapors are concentrated and at low temperatures. This reduces the total energy requirements and off-gas processing cost.

When volatile organic compounds are present, a vapor tight system with an inert gas can be used. Controlled humidity in the processor allows hygroscopic materials to be processed.



Drying with off-gas processing



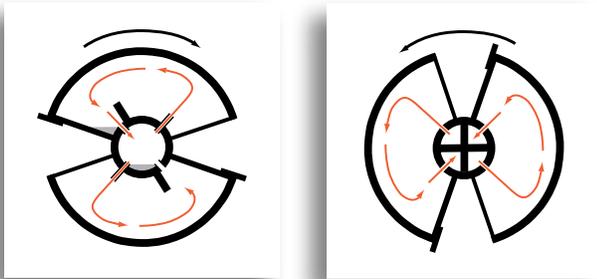
Model 8W - Dual counter-rotating shafts with intermeshing wedge-shaped paddles produce uniform mixing and optimize heat transfer.

K-S Paddle Dryer/Cooler

Indirect heat transfer

A metal wall separates the process mass from the heat transfer medium (steam, oil, water, or glycol). As the material comes into contact with the trough and agitators, the process mass is heated or cooled via conduction with very high thermal efficiency. Heat is directly transferred to or from the process mass and not the gas stream.

A large heat transfer area to volume ratio is achieved by the use of hollow paddles, shafts, and a jacketed vessel, through which the heat transfer medium flows.



Steam

Steam enters the hollow shaft through a rotary joint and is evenly distributed to all paddles. Steam enters the paddles, regardless of their orientation. Condensate is removed with each revolution.

Liquid

Fluid enters and exits the hollow shaft through a rotary joint, and flows through the hollow paddles, regardless of orientation. Channelized flow patterns produce high liquid velocities resulting in uniform temperature distribution and high heat transfer coefficients.

Transports a wide range of materials

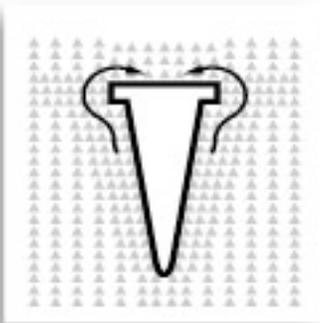
The K-S Paddle Dryer/Cooler transports most materials, regardless of their handling characteristics. Preconditioning the feed by mixing with recycled dry product to make it more conveyable, is rarely needed. This results in lower capital, operating, and maintenance costs and ease of operation.

Material is typically conveyed through the K-S Paddle Dryer/Cooler by displacement. As material is added at the feed end, it is assimilated into the bed by the mixing action of the agitators. Hydraulic head pressure, combined with the action of the wedge-shaped paddles, pushes material around and through the paddles. While there is a high degree of localized agitation, and some back mixing, the overall flow pattern can be described as a plug-flow movement down the processor.

Equal residence time for all particles produces uniform product quality. Residence time can be controlled by the height of the overflow weir or controlled by the removal of material with a bottom discharge screw.

For applications where low residence times are required or where very high volumes need to be conveyed, the paddles can be pitched and the processors can be inclined to increase the conveyance rate.





Wedge-shaped paddle

Rotating paddles penetrate the process mass, creating shear on the paddle and trough surfaces. Shearing "cleans" the surfaces and helps maintain high heat transfer rates.

The wedge-shaped paddles, and their intermeshing action, creates a localized circulation of individual particles and material, enhancing exposure to the heat transfer surfaces. This constant mixing also produces the self-cleaning effect and maintains the high heat transfer rate even when processing sticky material or material that goes through a sticky phase when being heated, dried, or cooled.

The counter-rotating shafts move process material away from the walls of the trough by means of the tab on the trailing edge of each paddle.

Self-cleaning

Dual counter-rotating shafts with intermeshing wedge-shaped paddles result in a high material mixing rate and a self-cleaning effect which optimizes the heat transfer rate. This is due to the shearing forces developed over the slanted surfaces of the revolving wedge-shaped paddles as they move through the process material.

Low operating const

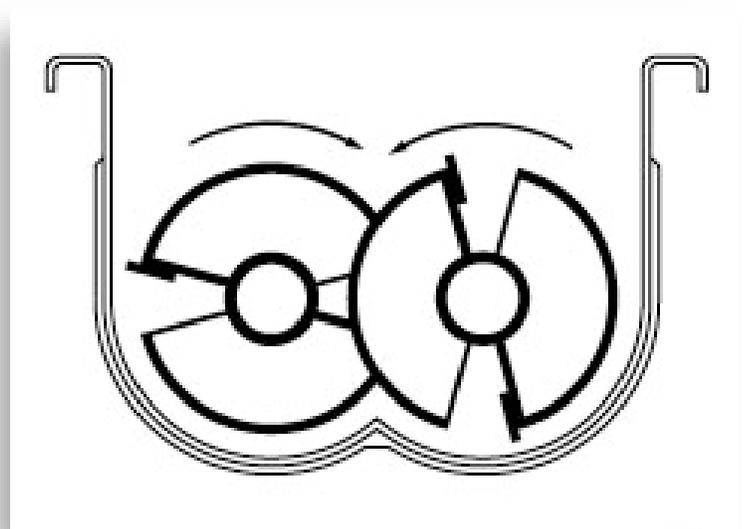
- Easy to operate
 - requires minimal attention
 - simple instruments monitor the process
- High efficiency
- Low off-gas volume

Low maintenance cost

- Designed for high torque and low operating speed
- Simple durable design for easy and low maintenance
- No internal parts to adjust or maintain
- No metal to metal contact
- Shafts, pillow block bearings, and drive components are designed for long life under adverse conditions, assuring long term mechanical integrity

Low installation cost

- Compact
- Integral base
- Small off-gas system
- Overhead shaft removal reduces building size requirements



Dual counter-rotating shafts

Sizes

Sizes range from the Model 1.6W, having 30 square feet of heat transfer area, to the Model 15W, with over 3,000 square feet.

Materials of construction

- Carbon steel
- Stainless steel
- Carpenter 20
- Hastalloy
- Titanium
- Abrasion-resistant hard-surface coatings
- Other materials are available

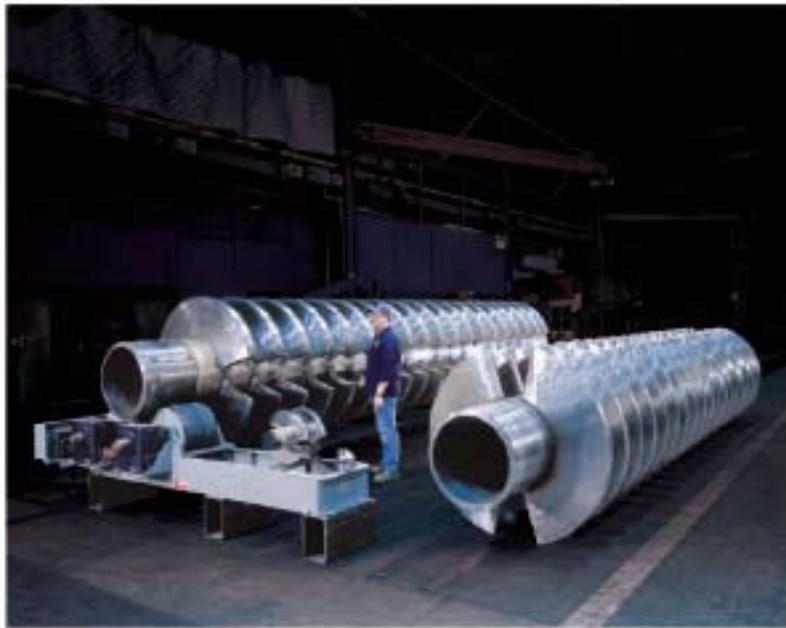
Process design

- Heat transfer medium
 - Steam from 30 to 300 psig or higher
 - Hot oil up to 750°F (400°C)
- Cooling fluid down to -40°F (-40°C)
- Continuous or batch operation
- Atmospheric, pressure, vacuum enclosures

Polished surface finishes

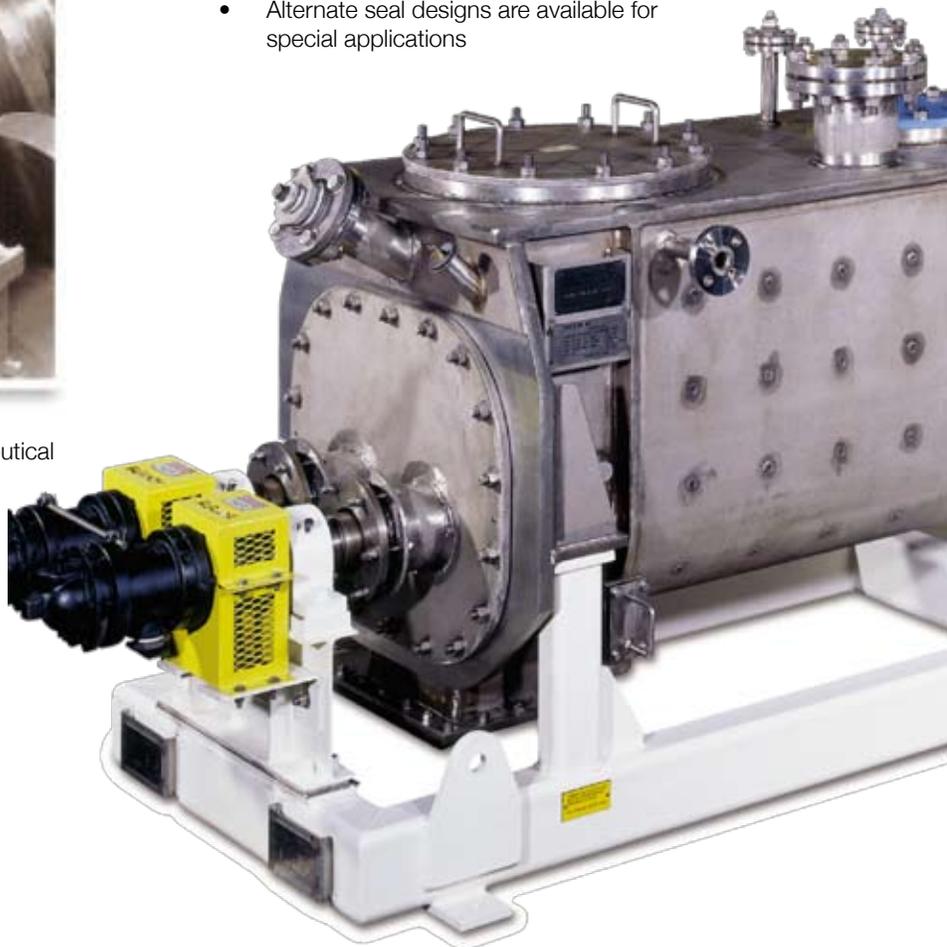


K-S offers a variety of finishes to meet food, pharmaceutical and fine chemical application standards that require polished surfaces and welds.



Mechanical features

- Designed, constructed, and stamped per ASME code
- Robust frame supports pillow block bearings
- Stuffing boxes with lubricant or purge lantern rings
- Alternate seal designs are available for special applications



Demonstrated capabilities and process experience

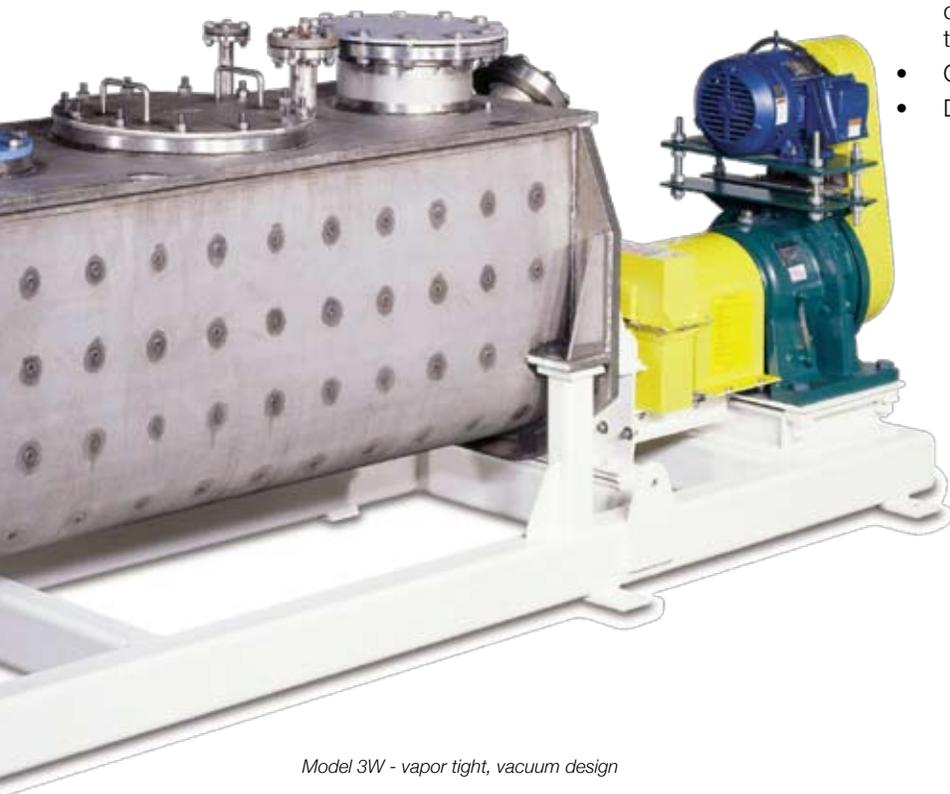
- Over 1,000 installations worldwide
- Over 30 years of successful experience with complex, demanding processes
- Sold worldwide by Koline-Sanderson

System design and project execution

A successful installation depends on the integration of the key process units with properly selected ancillary equipment and the right facility design. Reliability, ease of operation, rugged construction, performance and superior customer service are all hallmarks of a K-S installation.

Koline-Sanderson will:

- Provide a complete system
- Assist you in selecting the components required to complete the system
- Design a customized Instrumentation and Controls package, or integrate our equipment into your existing control system
- Assist you in all phases of the project



Model 3W - vapor tight, vacuum design

Scale-up and pilot test

Testing is an important part of most projects. K-S can provide pilot testing at our laboratory or at your plant. Pilot units are available for process testing, to generate design data, and to produce product samples.

Scale-up from pilot plant tests to full scale units uses a calculation model which has been proven reliable by its successful application in many units now in operation.



Test program objectives:

- Verify the application
- Confirm the heat transfer rate
- Develop an understanding of the materials handling and transport characteristics
- Evaluate the effect of process variables on heat transfer rates and product characteristics
- Demonstrate the impact that the temperature differential between the heat transfer medium and the product has on processing time
- Obtain "hands-on" experience
- Develop system design requirements

Komline-Sanderson technology and equipment



Drying technology for sludges and by-products



Weight reduction
Volume reduction
Sterilization
VOC removal
Reclamation

Liquid/Solid separation for process applications



Filter
Dewater
Clarify
Extract
Cake Washing
Product recovery

Wastewater treatment and sludge management



Clarify
Thicken
Dewater
Dry
Pump

Komline-Sanderson . . .

Reliability, ease of operation, rugged design, proven performance, and excellent customer service are hallmarks of Komline-Sanderson installations.

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