

## ***Processing Solutions for Thermal Coal Drying & Beneficiation***

Coal drying and beneficiation is much different than drying many other bulk solid materials. Carrier Vibrating Equipment has designed drying systems for a wide range of coal and applications. From run-of-mine coal, fines, steam and filter cake to washed and sized bituminous coal, reclaimed waste, coke or metallurgical-grade and sub-bituminous or lignite coal, Carrier delivers efficient systems for each of these coal types, all specifically designed for each application.

For example, since filter cake coals are very fine and typically hold a high volume of water, a dryer must be able to handle high evaporative loads and high entrainment levels in the exhaust gases. Some coals, such as lignite, are subject to spontaneous combustion and explosions. A dryer for lignite beneficiation prior to gasification or liquefaction, should be designed with explosion venting, a water deluge system and possibly an inert gas or a recirculated self-inert process gas.



Trusted in this Industry for over 70 Years

### ***Equipment for Thermal Coal Drying & Beneficiation:***

- Vibrating Fluid Bed Dryers
- Static Fluid Bed Dryers
- Flash & Tornesh Dryers
- Vibrating Feeders
- Vibrating Bin Dischargers
- Vibrating Storage Pile Dischargers





## Vibrating Fluid Bed Dryers & Coolers

Vibrating fluid bed dryers are typically used for coals with a larger size fraction such as run-of-mine, anthracite, bituminous, sub-bituminous and lignite coals. Vibration assists with the fluidization to improve heat transfer and support the processing of large wet coals. Carrier offers custom vibrating fluid bed units to accommodate your process thermal load requirements.



### Features & Benefits

- Optimized fluidizing velocity and vibration provides maximum energy efficiency
- Plug flow delivers consistent first-in, first-out output of materials
- High temperature designs provide minimal footprint and maximum efficiency
- Zoning allows multiple functions such as simultaneous drying, classification, and cooling to be performed



### Patented Delta-Phase® Drive

Make on-line changes to the angle of vibration for precise control of retention time.

### Options

- Patented Delta-Phase® drive
- Variety of fluidizing deck designs
- Dry only or dry and cool units
- Re-circulated gas and closed-loop systems
- Access manways & doors
- Custom controls

## Static Fluid Bed Dryers & Coolers

Static fluid bed dryers are ideally suited for coals with a smaller size fraction, such as washed crushed coals or fines. Lower rank coals such as sub-bituminous, PRB, or lignite coals that tend to thermally breakdown while being dried are efficiently processed with static fluid bed dryers.

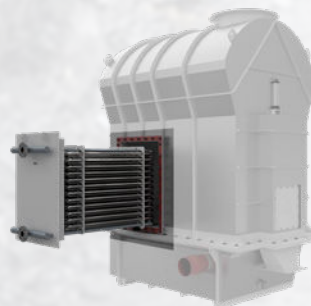
### Features & Benefits

- Efficient fluidizing design for optimal heat transfer with low energy consumption
- Zoning allows multiple functions such as simultaneous drying, classification, and cooling to be performed
- Material is continuously mixed while in the bed, creating uniformity in drying and blending



### Options

- Immersed heat exchangers
- Variety of fluidizing deck designs
- Custom system arrangements
- Access manways & doors
- Custom controls



### Immersed Heat Exchanger

Immersed heat exchanger tubes can be added to the fluidized bed area for indirect heat transfer for both drying and cooling.

## Flash Dryers

Conventional flash dryers offer quick drying of fine pulverized coal or filter cake. Recirculating the process gas can be beneficial for drying lower rank coals by rendering the process inert to help prevent potential explosions.

### Features & Benefits

- High gas temperature and active heat exchange design quickly dries and simultaneously transports materials
- Flash design is capable of processing high capacities in a relatively small amount of space
- Pneumatic conveying while simultaneously flash drying eliminates additional equipment

### Options

- Cage mills or mechanical slingers for deagglomeration needs
- High temperature designs

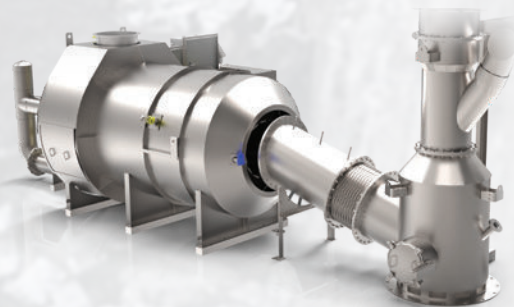


### Cage Mills/Slingers

Optional cage mills or mechanical slingers provide deagglomeration of lumps.

## Tornesh Dryers

Tornesh flash dryers provide longer retention time and higher drying efficiency than conventional flash dryers. Its feeding-dispersing chamber creates a multi-phase, cyclonic flow of gas and powder to help break up agglomerates of fine coals.



### Features & Benefits

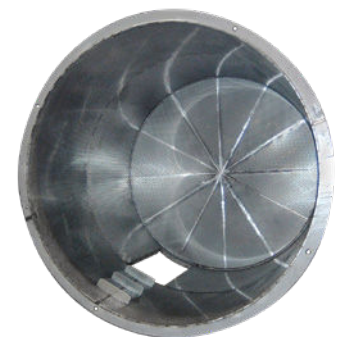
- Innovative design provides quick drying of wet coals
- Feeding-dispersing chamber generates cyclonic flow of gas/solids for increased residence time
- Adjustable retention time provides precise process control
- Process gas can be re-circulated to reduce emissions, save energy or recover vapors

### Options

- Custom feed designs
- Expansion chambers
- Single-stage & two-stage dryers

### Feed Chamber Basket

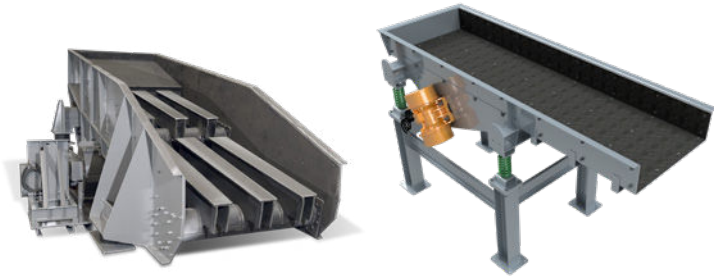
The feed chamber basket is customized with specially designed directional holes to generate spin.





## Vibrating Feeders & Screeners

Heavy-duty vibrating feeders are suitable for unloading hoppers and transferring coal. Carrier also provides Grizzly feeders to scalp large coal to be crushed. Wear liners ensure that the machine is not permanently damaged by the transfer of abrasive coals.



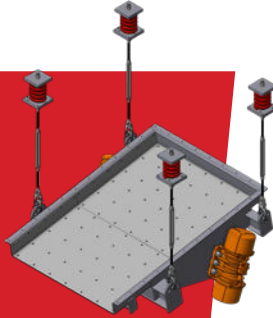
Grizzly Feeders

### Features & Benefits

- Heavy-duty designs to handle large headloads in severe operating environments
- Fixed or adjustable feed rates provide versatility for different process requirements
- Custom and multiple screening decks

### Isolation Arrangements

Feeders suspended above allow easy transfer of dried coal to trucks, rail cars or downstream in process lines.



### Options

- Several isolation arrangements including suspended from above for easy transfer of coals
- Scalping or screening decks, removable dust-tight covers, overhead drive arrangement, explosion-proof motors

## Vibrating Bin Dischargers

Vibratory bin dischargers are proven to enhance the flow of dried coal from storage. Carrier's bin dischargers promote plug flow from hoppers without rat holing, segregation or bridging. Available configurations include vibrating bin discharger, vibrating live bins and live bottom hoppers.

### Features & Benefits

- Suspension system with heavy-duty hanger arms to isolate silos/hoppers from the vibrating forces
- Internal pressure cone provides the energy transmission necessary for positive material flow
- Simple vibratory drive delivers quiet, reliable operation
- 45° heavy-duty outer cone for structural rigidity



### Options

- Totally enclosed vibratory motors to meet various area classifications
- Eccentric outlets, multiple outlets, and custom sizes
- Up to 15 foot diameters available

### Distributing with Bin Dischargers

Discharge quickly and efficiently into trucks or rail cars using the aid of our bin dischargers.



## Vibrating Storage Pile Dischargers

Storage pile dischargers are proven to enhance the flow of dry bulk materials from storage. Their sloped, heavy steel draw-down skirt maintains constant vibratory contact with the bulk solid materials and transmits impulses from bottom to top. This typically produces a draw-down angle greater than its natural angle of repose to increase the live storage area and eliminate flow stoppages.

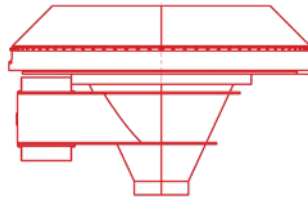
### Features & Benefits

- Unique design increases “live” storage area of stockpiles reducing the need for reclaiming material from above
- Produces a predominantly vertical flow-stream of predictable diameter to withdraw uniformly and concentrically as well as maintain constant command of top layer sloughs
- Controlled vibrating action promotes the flow of stockpiles and can be adjusted to deliver continuous flow of bulk solids



### Options

- Controlled vibrating action promotes the flow of stockpiles and can be adjusted to deliver continuous flow of bulk solids
- Various diameters and capacities available



### Versatile Configurations

Adaptable to any existing installation, such as flat bottom bins, stacking towers, reclaim piles, and rail car unloading.

## Typical Coal Drying Arrangements

- Dry-only or systems that dry and cool
- Recirculate the cooling zone exhaust gas to the drying zone supply
- Closed loop recirculated process gas streams that are heated with a direct-fired process gas heater
- Closed loop recirculated process gas streams that are heated with indirect heat
- Recirculated self-inert process gas streams heated by direct-fired process gas heaters
- Recirculated indirect heated inert process gas streams, such as nitrogen, with in-bed heat exchangers



### Complete System Integration for Thermal Coal Drying & Beneficiation

Carrier Vibrating Equipment can help with the design and selection of complete processing solutions for the beneficial use of coal combustion products (CCP's).





## Engineering & Manufacturing

- Technology profile of over 150 patents
- Equipment designs are verified using Finite Element Analysis (FEA) to ensure trouble-free service and long life
- 3D equipment modeling
- State-of-the-art manufacturing facilities on 3 continents with robotic cutting and welding
- Manufacturing expertise working with mild steel, various grades of stainless steel, duplex steels and other exotic alloys for specialty applications
- Welders certified to ASME & AWS standards
- ISO 9001:2015 certified



## Lab Testing

Be confident that your processing is efficient with CPEG's 15,000 ft<sup>2</sup> state-of-the-art test lab. With our lab, you have access to the most extensive testing capabilities in the industry. Multiple pieces of equipment can be combined for multistep and multistage testing to simulate field operation, validate new equipment designs and provide complete process solutions. Combined with our full analysis of material characteristics and measurements of material behavior in specific processing applications, you are assured an efficient, reliable and safe solution, all backed by our process warranty. Field testing with rental equipment is available when lab testing would not effectively simulate process operating environments.

## Aftermarket Parts & Services

Carrier offers a full line of aftermarket parts for its equipment. Our Aftermarket Sales Team will assess your parts needs and recommend the best solution. Our engineers are available to assist in any redesign or retrofit your existing equipment for new applications.

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